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FINAL REPORT

1969 ATMOSPHERIC REACTION STUDIES IN THE LOS ANGELES BASIN

VOLUME I

PROGRAM DESIGN AND METHODOLOGY
DATA SUMMARY AND DISCUSSION

Prepared for

COORDINATING RESEARCH COUNCIL, INC.

NATIONAL AIR POLLUTION CONTROL ADMINISTRATION

(Contract No. 70 - 6)

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A comprehenisve survey of the atmosphere of the Los Angeles Basin was conducted during the period August 18 to November 14, 1969. A large number of contaminants were determined continuously and periodically, and readings of pertinent meteorological factors were made at two ground level sites and in vertical profiles above the ground sites.
Two 8' x 35' mobile trailer-type laboratories were used in the study. Each contained instrumentation for continuous monitoring of a number of contaminants, photochemical products and meteorological parameters and chromatographs and wet chemical apparatus for determining a large number of additional pollutants periodically. The pollutants measured included carbon monoxide, oxidant, ozone, nitric oxide, nitrogen dioxide, total hydrocarbons, individual C_1 to C_{10} hydrocarbons, peroxyacetyl nitrate and total aliphatic aldehydes. The meteorological elements monitored included temperature relative humidity, wind speed and direction, and ultraviolet radiation intensity.

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Final Report

1969 Atmospheric Reaction Studies in the Los Angeles Basin

APRAC Project CAPA 7-68

Volume I

Program Design and Methodology
Data Summary and Discussion

for

Coordinating Research Council, Inc.

and

National Air Pollution Control Administration
(Contract No. CPA 70-6)

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Table of Contents

Page

1. INTRODUCTION -------- 1-1
    1.1 SUMMARY OF 1968 PROGRAM -------- 1-1
    1.2 LONG RANGE OBJECTIVES -------- 1-2
    1.3 OBJECTIVES OF 1969 PROGRAM -------- 1-3
    1.4 OUTLINE OF REPORT -------- 1-4

2. EQUIPMENT AND PROCEDURES -------- 2-1
    2.1 MOBILE LABORATORIES -------- 2-1
    2.2 INSTRUMENTATION AND PROCEDURES FOR CHEMICAL ANALYSIS -- 2-1
    2.3 METEOROLOGICAL MEASUREMENTS FROM GROUND LEVEL -------- 2-7
    2.4 MEASUREMENTS FROM A TETHERED BALLOON -------- 2-10
    2.5 AIRCRAFT -------- 2-11
    2.6 AIRBORNE INSTRUMENTATION -------- 2-11
    2.7 AIRCRAFT SAMPLING AND MEASUREMENT TECHNIQUES -------- 2-13
    2.8 RECORDING OF CONTINUOUS DATA -------- 2-14
    2.9 PROCESSING OF MAGNETIC TAPES -------- 2-15
    2.10 GENERATION OF DISK FILES AND DATA PRINTOUTS -------- 2-18
    2.11 PROCESSING OF THE INDIVIDUAL C_1 TO C_{10} HYDROCARBONS --- 2-34

3. PROGRAM DESIGN AND OPERATIONS -------- 3-1
    3.1 TEST SITES -------- 3-1
    3.2 TEST PROGRAM AT GROUND SITES -------- 3-2
    3.3 AIRBORNE PROGRAM -------- 3-2

Table of Contents

Page

3.4 COOPERATION WITH ESSA PROGRAM ------------------------ 3-5

3.5 BALLOON PROGRAM ------------------------------------- 3-6

4. DESCRIPTION OF DATA FILE ------------------------------ 4-1

5. EVALUATION OF INSTRUMENTATION AND PROCEDURES --------------- 5-1

5.1 SAMPLING SITES AND LOCATIONS ------------------------- 5-1

5.2 MEASUREMENT OF CHEMICAL PARAMETERS ------------------- 5-3

5.3 METEOROLOGICAL INSTRUMENTATION ----------------------- 5-7

5.4 AIRBORNE INSTRUMENTATION ---------------------------- 5-8

5.5 BALLOON TELEMETRY INSTRUMENTATION --------------------- 5-9

5.6 DATA LOGGERS -- 5-10

6. SUMMARY OF GROUND DATA ---------------------------------- 6-1

7. DISCUSSION OF DATA FOR SEPTEMBER 29, 1969 ------------------ 7-1

7.1 COMMERCE GROUND DATA -------------------------------- 7-1

7.2 EL MONTE GROUND DATA -------------------------------- 7-5

7.3 AIRBORNE DATA -------------------------------------- 7-9

7.4 ESSA DATA --- 7-17

7.5 SUMMARY --- 7-19

8. MISCELLANEOUS OBSERVATIONS ON INTERESTING PHENOMENA -------- 8-1

Table of Contents

Page

9. ACKNOWLEDGEMENTS --- 9-1

10. REFERENCES --- 10-1

SUMMARY

A comprehensive survey of the atmosphere of the Los Angeles Basin was conducted during the period August 18 to November 14, 1969. A large number of contaminants were determined continuously and periodically, and readings of pertinent meteorological factors were made at two ground level sites and in vertical profiles above the ground sites.

to page 1-4

Two 8' x 35' mobile trailer-type laboratories were used in the study. Each contained instrumentation for continuous monitoring of a number of contaminants, photochemical products and meteorological parameters and chromatographs and wet chemical apparatus for determining a large number of additional pollutants periodically. The pollutants measured included carbon monoxide, oxidant, ozone, nitric oxide, nitrogen dioxide, total hydrocarbons, individual C_1 to C_{10} hydrocarbons, peroxyacetyl nitrate and total aliphatic aldehydes. The meteorological elements monitored included temperature, relative humidity, wind speed and direction, and ultraviolet radiation intensity.

A Cessna Model 182 aircraft was equipped to measure air temperature, relative humidity, oxidant, and both incoming and outgoing ultraviolet irradiation. Facilities to sample oxides of nitrogen, carbon monoxide and hydrocarbons in Tedlar bags were also included.

The trailers were located in Commerce and at El Monte airport. These two sites were 10 miles apart along a prevailing air trajectory. The airport site facilitated transfer of airborne samples. Periodic sampling and analysis was performed during the time of day which normally included contaminant buildup and maximum oxidant formation. Aircraft flights were scheduled for morning and afternoon on days of moderate to heavy smog.

Vertical profiles were recorded over each ground site and Hawthorne airport, and samples were collected at specific altitudes within the inversion layer. Special investigations of smog fronts were made on several occasions. Samples collected aloft by ESSA were analyzed as part of a cooperative program.

A total of nearly 500,000 data points was reduced, tabulated and presented in three volumes. These included ten minute averages for parameters measured on the ground and values at 10 second intervals for the vertical profiles. Data for individual C_1 to C_{10} are included for more than 750 air samples. A summary of the maxima and minima for six chemical parameters for each day and for one hour and eight hour periods were also tabulated.

A detailed discussion of the data for September 29, a day on which very high oxidant was found, is presented to show the interrelationship between the ground data from Commerce and El Monte, the vertical profile data for three sites and the ESSA air trajectory data. This demonstrates the vast differences that can occur in a cross-section of the Los Angeles Basin and illustrates how the various data can be utilized in defining the aerometric history of a typical smoggy day. Additional data related to interesting and unusual phenomena which were documented in the data file are also discussed.

1. INTRODUCTION

This report describes the work performed by Scott Research Laboratories, Inc. on APRAC Project No. CAPA-7-68, "Atmospheric Reaction Studies in the Los Angeles Basin" (Contract No. CPA 70-6). This project was sponsored jointly by the National Air Pollution Control Administration and the Coordinating Research Council, Inc.

This report is contained in four volumes. Volume I includes a complete description of the study methodology as well as a thorough representation of the quantitative and qualitative results obtained. Volumes II, III and IV contain all of the relevant data which were collected in the test operations displayed as 10 minute averages for ground data and by altitude for vertical profiles.

1.1 SUMMARY OF 1968 PROGRAM

A comprehensive survey of the atmosphere of the Los Angeles Basin was conducted during the period August 22 to November 14, 1968. Two 8' x 35' mobile trailer-type laboratories were fabricated and used for both continuous and periodic measurement of a number of contaminants, photochemical products and meteorological parameters.

The pollutants measured included carbon monoxide, oxidant, ozone, nitric oxide, nitrogen dioxide, total hydrocarbons, individual C_1 to C_{10} hydrocarbons, peroxyacetyl nitrate, formaldehyde, acrolein and total aliphatic aldehydes. The meteorological elements monitored included temperature, relative humidity, wind speed and direction, and ultraviolet radiation intensity. The most significant advance in the analytical art was the chromatographic determination of more than 100 individual hydrocarbons from C_5 to C_{10} with a sensitivity in the tenth of a part per billion range by the use of a capillary column with on-column freeze-out.

An instrumented Waco Model 220-S aircraft was used to measure air temperature, relative humidity, oxidant, and both incoming and outgoing ultraviolet irradiation. Facilities to sample oxides of nitrogen in bubblers and carbon monoxide and hydrocarbons in Tedlar bags were also included.

The trailers were located in Huntington Park and at El Monte airport. These two sites were 12.7 miles apart along a prevailing air trajectory. The airport site facilitated transfer of airborne samples. Periodic sampling and analysis was performed during the time of day which normally included contaminant buildup and maximum oxidant formation. Aircraft flights were scheduled for morning and afternoon on days of moderate to heavy smog. Vertical profiles were recorded over each ground site and samples were collected at specific altitudes within the inversion layer. Special investigations of smog fronts were made on several occasions.

A total of nearly 100,000 data points was reduced and tabulated. These included half-hourly averages for elements measured continuously on the ground and values at altitude increments of 100 feet for the airborne measurements.

1.2 LONG RANGE OBJECTIVES

The ultimate objective of these studies is to develop a working model of the Los Angeles Basin atmosphere which can be used to define the qualitative and quantitative aspects of photochemical smog. With this model it would be possible to predict the behavior of the system form day to day at various locations in the Basin, to designate the relative contribution of various contaminants and sources to photochemical smog, and to evaluate the effectiveness of possible control measures in reducing smog manifestations. It should also be possible to follow the changes in contaminant concentrations from year to year and to project the smog levels for future years.

1.3 OBJECTIVES OF 1969 PROGRAM

In accordance with the long range goals of the program and the knowledge gained from the 1968 program, the objectives of the 1969 program were as follows:

1. Set up laboratories used in 1968 program at two sites: the USPHS Motor Vehicle Compliance Laboratory in the City of Commerce and at the El Monte airport.
2. Make continuous and periodic measurements of a large number of chemical and meteorological parameters for a minimum of 60 weekdays and 2 weekends during the period August 1 to November 14, 1969.
3. Make airborne measurements of as many parameters as practical in the vertical plane above the ground sites on at least 12 selected days during the period.
4. Make vertical measurements at the Commerce site at altitudes lower than permitted for aircraft by using tethered balloons (Kytoons).
5. Analyze air samples collected by ESSA on up to 15 days as part of ESSA air trajectory study.
6. Reduce the collected aerometric data, print it out in tabular

from page 6

form, and store it for future interpretation and analysis providing documentation of the data file structure and retrieval system.

In the report the following areas are discussed:

1.4 OUTLINE OF REPORT

Volume I of this report has been organized into 9 sections following the introduction.

Section 2 describes the equipment and methodology used in conducting the study.

Section 3 discusses the program design and test operations;

Section 4 itemizes the data file collected during test operations;

Section 5 presents an evaluation of the instrumentation and procedures used in the program,

Section 6 contains a summary of chemical parameters measured at the ground sites.

Section 7 provides an explanation of the data obtained for September 29 and shows the interrelationship between the data from the various program phases; and

Section 8 includes miscellaneous observations regarding interesting or unusual occurrences.

The report concludes with acknowledgements and references in Sections 9 and 10.

2. EQUIPMENT AND PROCEDURES

2.1 MOBILE LABORATORIES

The two 8' x 35' mobile trailer-type laboratories fabricated by Scott for the 1968 Los Angeles Basin Survey(1) (APRAC Project No. CAPA-7-68, Phase I) were used to collect aerometric data in the 1969 program. Additional equipment and instrumentation were added to both the government and Scott trailers. This permitted the acquisition of data for additional parameters and of more frequent data points for several important parameters. The installation of data loggers which recorded the outputs from the continuous monitoring instruments on magnetic tape made it possible to develop computerized data reduction procedures. A summary of the instrumentation contained in the trailers is given in Table 2-1.

2.2 INSTRUMENTATION AND PROCEDURES FOR CHEMICAL ANALYSIS

At the El Monte test site (Scott trailer) the atmosphere was sampled through an inverted cone located approximately four feet above the roof of the trailer and fifteen feet above the ground. Air was drawn rapidly through the sampling manifold which consisted of one-inch OD Pyrex tubing. Samples for the various instruments were taken through 1/4-inch Teflon tubing attached to sampling ports in the manifold.

At the Commerce site (government trailer) the inverted cone was located 65 feet above the ground, and it was connected to the trailer manifold by 75 feet of one-inch Teflon tubing. A halyard rigged on a mast was used to raise and lower the sampling line. The Acralyzers and Mast oxidant recorder would not operate properly when connected to the sampling manifold because

Table 2-1 Trailer Instrumentation

Instrument	Parameter Measured
Beckman Model 315 AL Infrared Analyzer*	Carbon Monoxide
Beckman Model 108A* - 109A** Total Hydrocarbon Analyzer	Total Hydrocarbons
Beckman Model K-78 Acralyzer*	Oxidant
Beckman Model K-75 Acralyzer*	Nitric Oxide, Nitrogen Dioxide
Mast Model 724-2 Ozone Recorder with Olefin Titration Apparatus	Oxidant, Ozone
Perkin-Elmer Model 900 Gas Chromatograph Infotronics Model CRS-100 Integrator-Printer	Individual C_1 to C_{10} Hydrocarbons
Varian Aerograph Model 1532-2B Gas Chromatograph with Helium Ionization Detectors**	Carbon Monoxide
Varian Aerograph Hy-Fi Model 1220-1 Gas Chromatograph with Electron Capture Detector	Peroxyacetyl Nitrate
SRL Multiple Gas Samplers Bausch and Lomb Spectronic 20	Nitric Oxide, nitrogen Dioxide, Aliphatic Aldehydes
Climet Wind Set	Wind Speed and Direction
Bendix Hygro-thermograph	Temperature, Relative Humidity
Eppley Radiation Photometer	Solar UV Radiation Intensity
Climet 016-2 Temperature and Dew Point Shield with 014-68 Thermometer* Climet 060 Translator*	Dew Point and Temperature
Dewey and Almy KYT-8000 Kytoon* Metrodata KT-10 Telemetry Unit, TR10 Receiver and TD24 Demodulator*	Relative Humidity, Temperature Horizontal and Vertical Wind Speed
Metrodata Model DL620A Data Logger	Data Storage on Magnetic Tape Cassette.

* Government Trailer Only

** Scott Trailer Only

the vacuum was too high, so a separate 1/4-inch Teflon sampling line was used for these instruments. Its inlet was located 25 feet above the ground.

2.2.1 Carbon Monoxide

Carbon monoxide was measured continuously with a Beckman Model 315AL Infrared Analyzer with a nominal range of 0 to 50 ppm. The analyzer contained an optical filter to eliminate interference from atmospheric moisture. The instrument was calibrated daily using Scott "Close Tolerance" Analyzed Gas Mixtures.

The Scott trailer contained an Aerograph Model 1532-2B Chromatograph with dual helium ionization detectors. This instrument was used to measure carbon monoxide at ground level and in airbrone samples which were collected in Tedlar bags. The carbon monoxide was separated with a 1/8 inch x 10 foot column of Type 5A Molecular Sieve, 60/80 mesh, operated at 50°C.

2.2.2 Oxidants and Ozone

In both trailers oxidants and ozone were monitored continuously with Mast Ozone Recorders equipped with olefin titration apparatus(2). The instruments were automated to record total oxidant and total oxidant less ozone in alternate 15 minutes cycles. Total oxidant was also monitored continuously in the government trailer with a Beckman Model K-78 Acralyzer.

2.2.3 Nitric Oxide and Nitrogen Dioxide

Nitric oxide and nitrogen dioxide were recorded continuously in the government trailer with a Beckman Model K-75 Acralyzer. These two contaminants were also determined periodically in both trailers using manual procedures. For both the instrumental and manual procedures the Saltzman absorbing solution was modified by replacing the N(1-naphthyl) ethylenediamine hydrochloride (NEDA) normally used as the coupling compound with N(1-naphthyl, acetyl) ethylenediamine (ANEDA). The former reduces approximatley 10 % of the nitrogen dioxide to nitric oxide, thus giving low results for nitrogen dioxide and high results for nitric oxide. Less than 2% reduction takes place with ANEDA.

The Acralyzer was modified by replacing the permanganate solution normally used to oxidize nitric oxide to nitrogen dioxide with more efficient chromic oxide impregnated glass fiber filters. A condensate trap was installed in front of the tube containing the oxidizer to remove the aerosol carried over from the nitrogen dioxide absorption column and thus preserve the life of the oxidizer. The condensate trap consisted of a modified MSA bubbler immersed in ice water. The oxidizer was changed daily. The Acralyzer colorimeters were spanned and zeroed daily with a standard of sodium nitrite in Saltzman solution as recommended in the operating manual.

Manual samples were collected in two midget impingers connected in series at flow rates of 160 ml per minute. Each impinger contained 10 ml of modified Saltzman solution, and a chromic oxide oxidizer was placed between the two impingers. The absorbances of the resulting solutions were measured with a Bausch and Lomb Spectronic 20 using one-inch diameter tubes for improved sensitivity.

A multiple port gas sampler constructed under Phase II of the 1968 program was utilized for collection of the manual samples. It accomodated eight sets of impingers and used No. 27 hypodermic needles for flow control orifices. Samples were generally collected for twenty minutes with overlapping sampling periods so that readings were obtained at ten minute intervals. In this procedure Sample 1 was collected from 0 to 20 minutes, Sample 2 from 10 to 30 minutes and Sample 3 from 20 to 40 minutes from the starting time, etc. Longer sampling times were employed when lower concentrations were present so that the color generated in the collecting solution was intense enough to produce accurate results.

2.2.4 Total Hydrocarbons

Total hydrocarbons were monitored with Beckman Total Hydrocarbon Analyzers at both sites. A Model 108A was used at Commerce and a Model 109A was used at El Monte. Both analyzers were calibrated daily employing a Scott "Close Tolerance" Analyzed Mixture of 10 ppm methane in hydrocarbon-free air as the span gas and Scott hydrocarbon-free air as the zero gas.

2.2.5 Individual C_1 to C_{10} Hydrocarbons

Samples were analyzed periodically for individual C_1 to C_{10} hydrocarbons using a Perkin-Elmer Model 900 Gas Chromatograph with dual flame ionization detectors and a sub-ambient temperature accessory. The C_1 to C_4 hydrocarbons were separated with a 1/8-inch x 20 foot column packed with Baymal (Colloidal Alumina). The C_5 to C_{10} hydrocarbons were separated with a 0.01 inch x 150 foot capillary column coated with Versilube F-50. Twenty five milliliter samples of air were concentrated directly on each column at -75°C. Liquid nitrogen, supplied through the sub-ambient accessory, was used to cool the column oven.

The following analytical cycle was employed:

1. Cool oven to -75°C and hold for several minutes with packed column valve in backflush position.
2. Inject sample into capillary column. (0 time)
3. Switch backflush valve to forward position at 170 seconds.
4. Inject sample into packed column at 180 seconds.
5. Raise temperature to -20°C at 240 seconds and hold for 60 seconds.

6. Program temperature from -20°C to 120°C at 6.5°C per minute.
7. Switch packed column to backflush at 1500 seconds.
8. Hold at 120°C to a total of 2000 seconds from injection.
9. Set oven temperature control to -75°C, air cool with oven lid raised for several minutes, and then close for liquid nitrogen cooling to -75°C.

The outputs of the two flame ionization detectors were recorded on a Texas Instrument dual pen recorder. The areas of the peaks from the capillary column were measured and recorded with an Infotronics Model CRS-100 Electronic Digital Integrator-Printer with a tape accessory. The retention times and peak areas were printed as well as punched on tape for later computer calculation.

The chromatographs were calibrated daily using multicomponent Scott Analyzed Gas Mixtures containing hydrocarbons which spanned the carbon number range eluted by each column.

2.2.6 Peroxyacetyl Nitrate

Peroxyacetyl nitrate was analyzed with an Aerograph Hy-Fi III Model 1220-1 Gas Chromatograph with an electron capture detector. A 1/8-inch x 7 meter Teflon column packed with 5% Carbowax 400 on 60/80 mesh Diaport S operated at room temperature. The chromatograph was automated so that determinations could be made at 20 minute intervals on an around the clock basis.

A mixture of propyl nitrate in nitrogen was used for daily instrument sensitivity checks. This mixture was found to be suitable for this purpose in studies carried out under Phase II of the 1968 program. The relationship between the response to the stable propyl nitrate mixture and unstable PAN was determined early in the 1969 program using an analyzed PAN mixture obtained from Dr. E. R. Stephens of University of California, Riverside. This provided a means of calculating the daily calibration factor for PAN.

2.2.7 Total Aldehydes

Total aliphatic aldehydes were determined manually using the 3-methyl-2-benzothiazonone hydrazone hydrochloride (MBTH) method. Samples were collected in two midget impingers in series at flow rates of one liter per minute. Determinations were made periodically employing 30 minute sampling periods. The absorbances of the resulting solutions were measured with a Bausch and Lamb Spectronic 20, and sample concentrations were calculated using factors obtained from solutions containing known concentrations of formaldehyde.

2.3 METEOROLOGICAL MEASUREMENTS FROM GROUND LEVEL

Meteorological sensors at the Commerce site were mounted on the roof of the building in which the trailer was housed. The wind speed and wind direction sensors were positioned atop a 50 foot mast mounted on the peak of the roof. The total height above street level was 75 feet. A weather bureau-type shelter positioned on the roof peak housed a Bendix hygro-thermograph for backup temperature and relative humidity measurements and served as a platform for an Eppley Ultraviolet photometer.

At El Monte temperature and relative humidity were measured by a Bendix hygro-thermograph housed in a louvered weather bureau-type shelter located atop the trailer. The shelter also served as a platform for the Ultraviolet sensor. Wind speed and direction were measured 65 feet above ground by mounting the wind sensors on a mast fixed to the top of the airport navigation beacon.

2.3.1 Climet Temperature and Dew Point System

The Climet Temperature and Dew Point System employs a motor-aspirated shield to house a temperature probe and a lithium chloride Dewcel probe. The transfer of air within the double walled section surrounding the temperature bulb, together with the highly reflective white paint limits radiation errors in less than 0.2°F. A small detent and vent in the vertical section provide the proper agitation of air for the Dewcel. The temperature probe uses a platinum resistance element as one leg of a wheatstone bridge. The resistance of the platinum element changes linearly with temperature, thus unbalancing the bridge. The small voltage caused by bridge unbalance is amplified and recorded.

The Dewcel is a humidity sensitive device consisting of a resistance thermometer inside a thin-walled metal tube, covered with a woven glass tape, and impregnated with lithium chloride. The tube is wound with a pair of gold overlay wires in a helix over the tape. When the lithium chloride salt absorbs moisture from the atmosphere it becomes a better electrical conductor, and current increases between the two-wire pair, thereby raising the temperature of the probe until equilibrium is attained.

For any given water vapor pressure in contact with the saturated salt solution in the probe there is an equilibrium temperature at which water is neither given up nor absorbed by the salt solution. Here the vapor pressure exerted by the water in the solution is equal to the partial pressure of the water vapor in the atmosphere. This equilibrium temperature (dew point), which represents the partial pressure of the water vapor in the atmosphere, is measured by a platinum resistance thermometer.

2.3.2 Solar Ultraviolet Radiation Intensity

Solar ultraviolet radiation intensity at a wavelength of 290-390 mμ was measured by means of a standard Eppley band pass filter-photocell photometer. During the program the calibration was maintained by frequently checking against a set of factory-supplied tungsten-in-quartz-iodine lamps.

2.3.3 Hygro-thermograph

Temperature and relative humidity at El Monte were recorded on a curvilinear chart by means of a Bendix Hygro-thermograph. A similar instrument was used as back-up at Commerce. The temperature sensor element of this instrument is a highly polished gold Bourdon tube. The humidity element is a multiple strand of specially treated hygroscopic human hair. Through a system of linkages these elements operate individual recorder pens. The relative humidity is recorded with an accuracy of 3% R.H. between 20 and 80% and 5% at the extremes. The temperature range is from 10 to 110°F with an accuracy of ±1°F.

2.3.4 Wind Speed and Direction

Wind speed and horizontal wind direction were measured at both sites with a Climet 540-Degree Wind Recording System. This system combines low threshold, high sensitivity and accurate performance with an "ambiguous point logic" recording technique that eliminates the hard-to-interpret "crossover" region of conventional 0-360 degree polar wind systems. In addition, the vertical wind direction was recorded at Commerce by means of a bi-vane which responds to both horizontal and vertical wind direction. The vertical range was from +60° to -60° from horizontal.

The accuracy of the wind speed sensor is ± 1% of true or ±0.15 mph whichever is greater, and it has a threshold of 0.75 mph. The wind direction sensor has an accuracy of ±3° azimuth and a threshold of 0.75 mph.

2.4 MEASUREMENTS FROM A TETHERED BALLOON

A tethered balloon was used to obtain meteorological measurements at an altitude of 150 feet above ground at Comerce. It was planned to fly the balloon at an altitude of 500 feet or higher, but the refusal of the FAA to waive certain requirements because of the large number of helicopters in the area made this impractical. Included in the requirements was a self-destruct mechanism which is not commercially available and which, if constructed, would have added too much weight to the balloon system to permit lifting the desired instrument packages.

Two Dewey and Almy KYT8000 kytoons each inflated with 80 cubic feet of helium were used to lift a Metrodata KT-10 instrument package. This battery powered package measures temperature, relative humidity, vertical wind speed and horizontal wind speed and telemeters the data to a ground based receiver and demodulator. The KT-10 operates on a pulse position modulation principle and transmits in the 403 MH_z meteorological band.

The temperature sensing element is a thermistor and the relative humidity element is a hygristor, a carbon film resistor whose resistance changes with relative humidity. Horizontal wind speed is sensed by a 3-cup anemometer. Vertical wind speed is sensed by a symmetrical blade propellor mounted on a vertical shaft below the package.

A Metrodata Model TR-10 receiver and TD-24A demodulator were used to receive and demodulate the radio signals and translate them into digital signals which were recorded on the Data Logger.

2.5 AIRCRAFT

A Cessna Model 182 aircraft was used as the platform for airborne measurements. This single engine, high wing, four-place light plane has the advantages of a large cabin, good low speed characteristics as well as a 160-mph cruise speed, and a 12-volt, 50-ampere electrical system. Convenient under-wing and under-fuselage inspection plates were used to mount meteorological and UV sensors. Air sampling probes were mounted on the wing leading edge and sample lines run from these probes into the cabin through existing ventilation ducts.

The aircraft was leased from G & H Aircraft and operated from their main hangar facility at El Monte Airport which was near our El Monte ground site. The aircraft was hangared to insure aircraft and instrument security.

2.6 AIRBORNE INSTRUMENTATION

The instrumentation contained in the aircraft is summarized in Table 2-2.

The Rosemount thermometer was mounted on the left hand wind strut by a special bracket. The wet bulb thermometer was mounted under the wing on an inspection panel. The incoming UV sensor was mounted above the cabin on a bracket fashioned to hold the sensor level when the aircraft was in level flight attitude. The outgoing UV sensor was mounted under the fuselage on an inspection plate. Sample air for the oxidant analyzer and for the six-liter Tedlar bags was provided by two Teflon tubes passed through the aircraft leading edge ventilator duct and with the open tube ends projecting about two inches forward of the leading edge.

Table 2-2. Aircraft Instrumentation

Instrument	Parameter Measured
Rosemount - Platinum Resistance Thermometer	Air Temperature
Thermistor Wet Bulb Thermometer	Relative Humidity, Dew Point
Mast Microcoulumb Detector	Total Oxidant
Eppley Ultraviolet Photometers	Incoming and Outgoing Ultraviolet Radistion - 290-390 mμ
Six-Liter Tedlar Bags	Individual C_1 to C_{10} Hydrocarbons, Carbon Monoxide, Nitric Oxide, Nitrogen Dioxide
Aircraft Instruments	Aircraft Parameters - Airspeed, Heading, Attitude
CIC Model 7000 Altitude Transducer	Altitude

Recorders	Parameter Recorded
Metrodata Model DL620A Data Logger	Recorded digitally on magnetic tape oxidant and all meteorological parameters as well as bag sample numbers and special event markers. Time signals were generated and recorded by this unit as well.
Esterline Angus Model T171B Recorders	Analog records of Air Temperature, Wet Bulb Temperature and Incoming UV Radiation.

Aircraft power was utilized to operate the Mast oxidant detector and the Data Logger through a 100 VA inverter. The remaining instruments and recorders were powered by self-contained batteries. The right front seat was removed to make room for the Data Logger, low level amplifiers and Mast oxidant detector. Tedlar bag storage and the inverter were located behind the rear seat in the luggage area. Temperature, humidity and oxidant analog recorders and all instrument controls were mounted on the left rear seat. The observer sat in the right rear seat with easy access to all instrument controls and with all recorder traces in full view.

2.7 AIRCRAFT SAMPLING AND MEASUREMENT TECHNIQUES

The air sampling probes mounted on the wing leading edge were directed forward such that ram pressure pushed sample air through them. Air from one of these probes was directed through Teflon tubing to an expansion chamber where it was decelerated to cabin pressure. A small Teflon tube placed at 90° to this low velocity stream carried an air sample to the Mast oxidant meter. The Mast air inlet was immersed in sample air at cabin pressure, which gave an abundance of sample air with no pressure fluctuations across the oxidant detector. The Tedlar bags were filled with air samples from another ram pressure line by connecting the tube to a bag. The six-liter bags were filled in less than 10 seconds. The samples collected in Tedlar bags were protected from UV radiation by placing the bags in a large opaque black plastic pouch. The bag samples were analyzed on the ground for carbon monoxide, nitric oxide, nitrogen dioxide and individual C_1 to C_{10} hydrocarbons. When not being used in airborne sampling, the Mast oxidant recorder was kept running on ground power in order to insure proper operation and accurate results.

Time, air temperature, wet bulb temperature, incoming and outgoing ultraviolet radiation, oxidant concentration and altitude were recorded on the data logger at 10 second intervals. The aircraft was leveled in pitch and roll at regular altitude intervals when climbing or descending to align the ultraviolet sensors to the vertical. At this time a hack mark was placed on the data logger. The bag sample numbers were also recorded at the time the samples were collected.

2.8 RECORDING OF CONTINUOUS DATA

The outputs from the continuous monitoring instrumentation in both trailers and in the aircraft were recorded in digital form on magnetic tape with Metrodata Model DL620A Digital Data Systems. These data loggers each had 20 channels with 2 channels used for a presettable real time clock and the remaining 18 available for recording analog signals from instrumentation or digital codes which aided in subsequent computer processing of the tapes. In actual practice all codes were placed on a single channel. The codes indicated test site, day of month, calibration periods, off-line periods, etc.

The loggers can be set to record continuously or at intervals from 10 seconds to 1 hour. On the continuous mode each channel is scanned 2.4 times per second while at the intermittent modes four sweeps are made of each channel during a 2 second period at each recording point. Initially the loggers were operated on the 10 second mode during the daytime and 1 minute mode overnight. However, the processing time for the number of tapes generated proved to be excessive, and the schedule was changed to 1 minute during the day and 10 minutes overnight. Each tape cartridge records for 1 hour in the continuous mode, 3 1/2 hours in the 10 second mode and 22 hours on the 1 minute mode. The final recording schedule thus generated less than 1 tape per day per site as compared to 3 tapes per day per site initially.

The standard input to the data logger was ±0-1 volt. Where the instrument output was less, e.g. 0-10 millivolts, pre-amplification was necessary. Pre-amplifiers were obtained as accessories to the loggers, and they were used to amplify the outputs of the Mast Oxidant Recorder and Beckman Total Hydrocarbon Analyzer at each ground site.

The outputs of the instruments were also recorded on strip charts to provide permanent visual records and serve as a backup for the loggers. The loggers were equipped with a set of Nixie tubes with a channel selector switch so that the voltage being recorded on tape could be compared with the readings on the instrument panels and strip charts. This was checked on a daily basis to verify logger performance.

2.9 PROCESSING OF MAGNETIC TAPES

The 1/4 inch magnetic tape cassettes containing the continuous monitoring data and special codes produced by the three data loggers were read into temporary disk files through a prototype Metrodata Systems DL622A Tape Reader and Interface to an IBM 1130 Computing System Storage Access Channel. Late delivery of the reader-interface unit and failure of the manufacturer to thoroughly check out this prototype unit caused a major initial delay in processing the tapes which had already been generated by the sampling program. The Scott unit was the first operational unit and several modifications and additions to the original program had to be made to successfully process the magnetic tapes. An example of these was the addition of a preliminary filtering program which checked the raw voltage polarities. By ulilizing the channel polarity pattern characteristic of each individual data logger, the tape source and identification were verified and offset data was eliminated. The latter had proven to be quite a problem since the frequent failure of a channel to record and the subsequent shifting forward of the channels following, had resulted in rejection of that entire data block and the abortion of the processing program. The inadequacy of the manufacturer-supplied control software to handle this situation necessitated the additional programming effort required to overcome this problem and to keep data loss at a minimum. Figure 2-1 illustrates the flow of data from the tapes, through the revised processing program, and to temporary storage in card form.

The processing program took the raw data from the temporary disk file and converted it into engineering units by either application of a conversion factor or, in the case of the Acralyzer-analysis data, by insertion into an equation and calculation. The converted data was then checked to see that it fell within predetermined limits thereby further eliminating false or erroneous data. Through a series of matrix manipulations and comparisons, the most representative reading of the four taken per sample on each channel was selected. This method of 4 to 1 reduction was selected over straight averaging since it prevented the acceptance of bad data points due to erroneous readings caused by power surges, spikes, tape inperfections, etc., which would not have been ascertained through straight averaging. At this point there was one data point per channel per sample interval.

Due to the necessity of eliminating the backlog of tapes caused

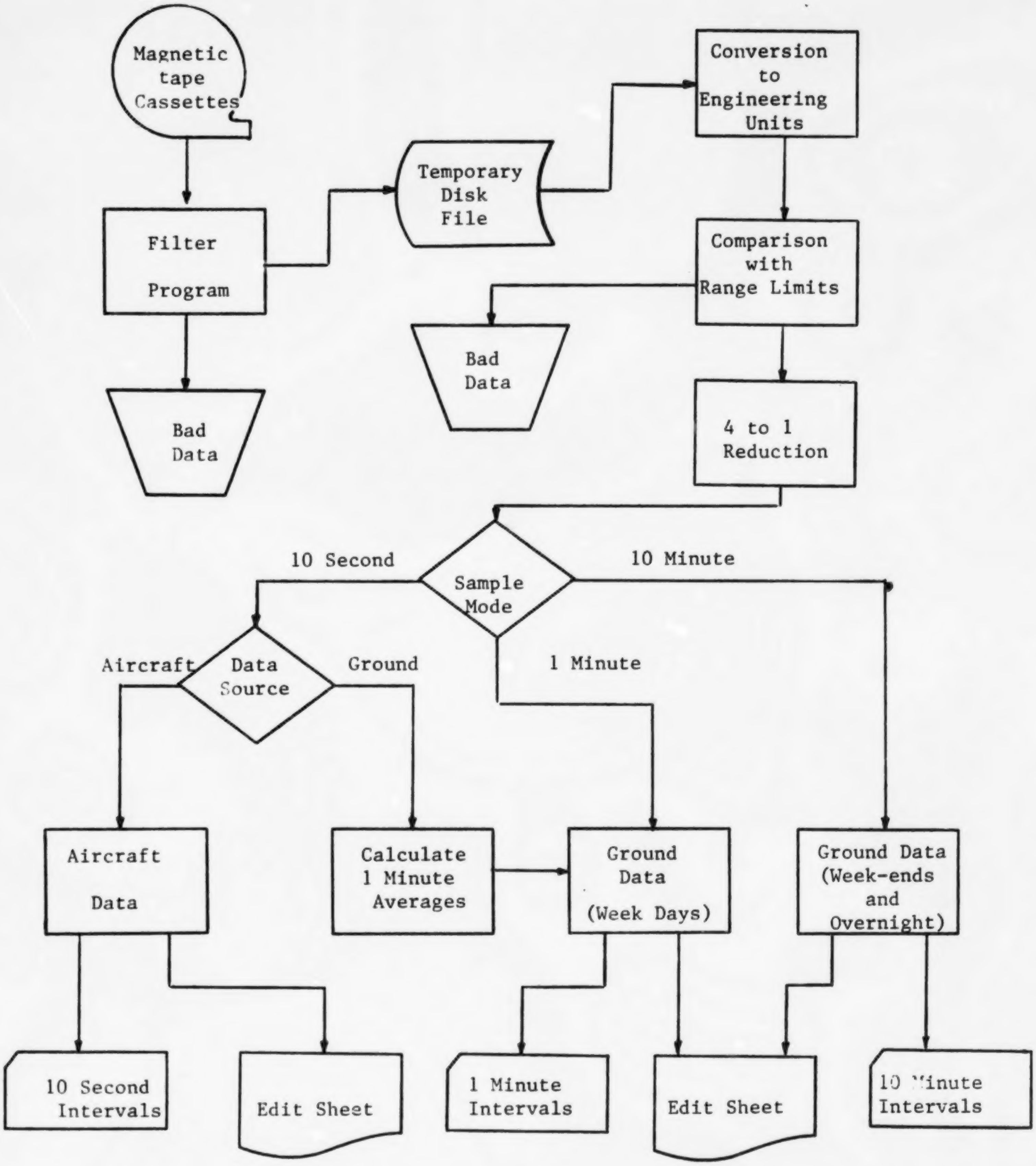


Fig. 2-1

PROCESSING PROGRAM FOR MAGNETIC TAPE DATA by the initial processing delays mentioned above, it was decided to temporarily store the reduced data in card form in time intervals synonomous with the original sampling mode, thereby creating the capability of utilizing more than one 1130 system for processing the temporary disk files. At the same time an edit listing of the reduced data was produced. The airborne data, sampled at 10 second intervals, was punched in the same time mode. The ground data, originally sampled in 10 second, 1 minute, and 10 minute intervals, was punched and stored in 1 minute and 10 minute intervals, the 10 second samples being averaged into 1 minute intervals. The balloon data, recorded by the Commerce logger, was left in raw voltage form since the balloon conversion program required more core than was allotted with the existing tape processing program. The card file thus generated was cataloged and stored for further processing, reduction, and loading into the final disk data files.

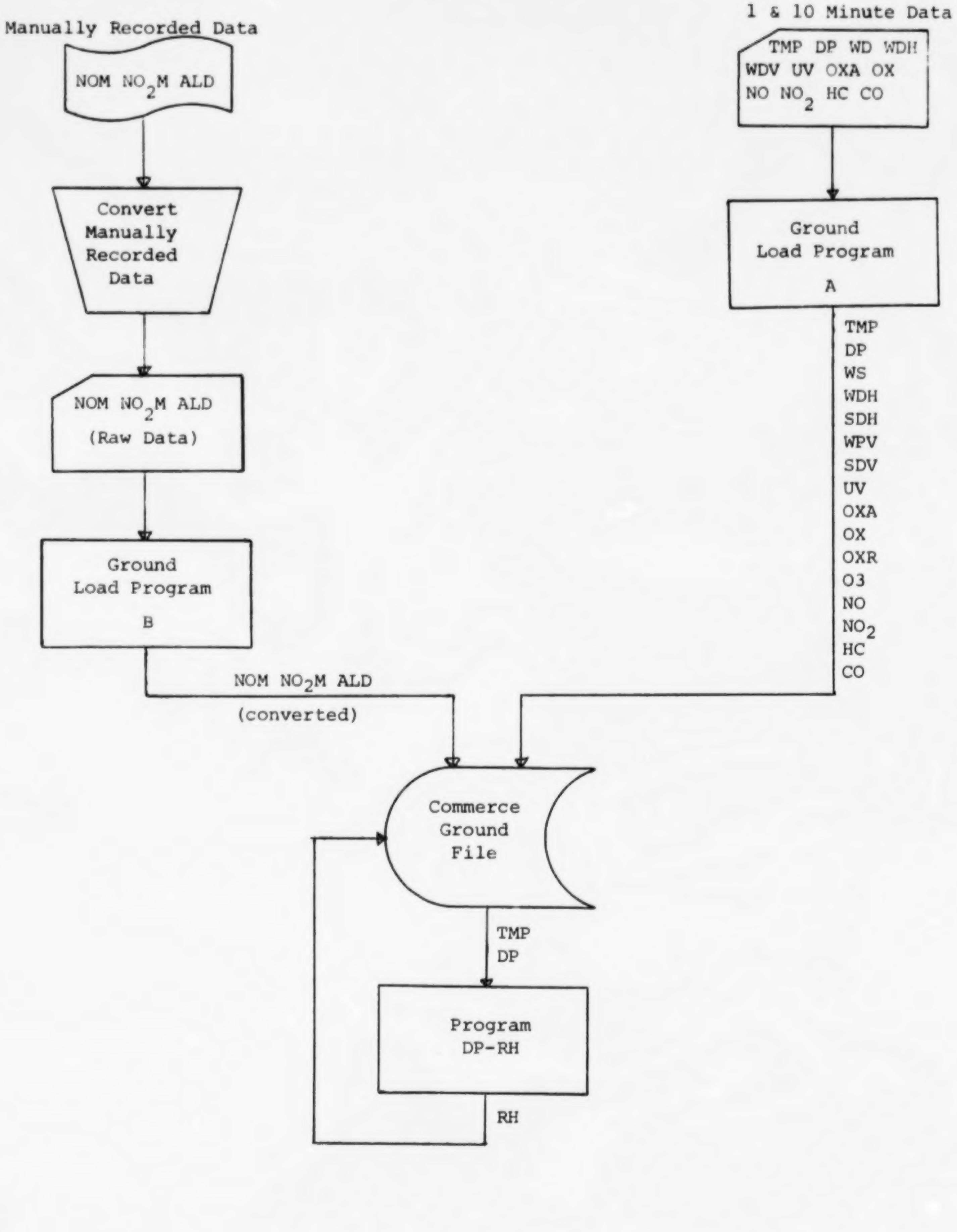
2.10 GENERATION OF DISK FILES AND DATA PRINTOUTS

Commerce Ground File

The magnetic tape data which had been reduced to cards was loaded as 10 minute averages in the appropriate computer disk file as shown in Figure 2-2. For Commerce the data recorded on cards were: temperature, dew point, wind speed, horizontal wind direction (recorded as 0° through 540°), vertical wind direction (recorded as 0° to 120°), ultraviolet radiation, oxidant from Acralyzer, output from Mast Oxidant Recorder and its titrator, nitric oxide, nitrogen dioxide, total hydrocarbons and carbon monoxide. Depending on the sampling mode, each card contained data representing either a one minute or a ten minute time period.

Figure 2-2 COMMERCE GROUND FILE

LOADING PHASE



The horizontal wind direction data were converted so that all data points in each ten minute period were within 180° of each other whenever possible. They were then averaged and stored as a number between 0° and 359°. The vertical wind direction data were averaged and then stored as a number between -60° and +60°. Standard deviations of both horizontal and vertical wind direction data points were computed and stored whenever there was more than one data point in a ten minute period.

It was assumed that there would be no ozone before 0700 and after 1900. Therefore, Ground Load Program A averaged the output of the Mast for these periods and stored it as both total oxidant and as residual oxidant. Ozone was set equal to zero. Between 0710 and 1900 the data points were stored in two arrays, one for one minute data and another for ten minute data. The titrator had a fifteen minute cycle time. Load Program A determined the maximum difference between two ten minute averages fifteen minutes apart and used these as synchronism points for the total oxidant and the residual oxidant. The ten minute averages of the one minute data lying in multiples of thirty minute intervals from these synchronism points were stored as either total oxidant or residual oxidant. The ten minute data was processed by using the two adjacent data points having maximum difference as the synchronism points and throwing away all data points not in multiple 30 minute intervals from these points. The larger of the two adjacent points was stored as total oxidant and the other as residual oxidant. Interpolation was then performed in the resulting data and ozone computed as the difference between total and residual oxidant. If, however, the ozone computed was less than 1.0 pphm, it was stored as 0.0 and residual oxidant was made equal to total oxidant.

The colorimetrically measured nitric oxide, nitrogen dioxide, and total aldehyde data were taken from the data sheets and keypunched on cards. Then using the appropriate equations, Ground Load Program B calculated the sample concentrations and put them into the appropriate time slot of the ground file.

Program DP-RH was then used to calculate the relative humidity from the temperature and dew point using accepted psychometric equations.

EL MONTE GROUND FILE

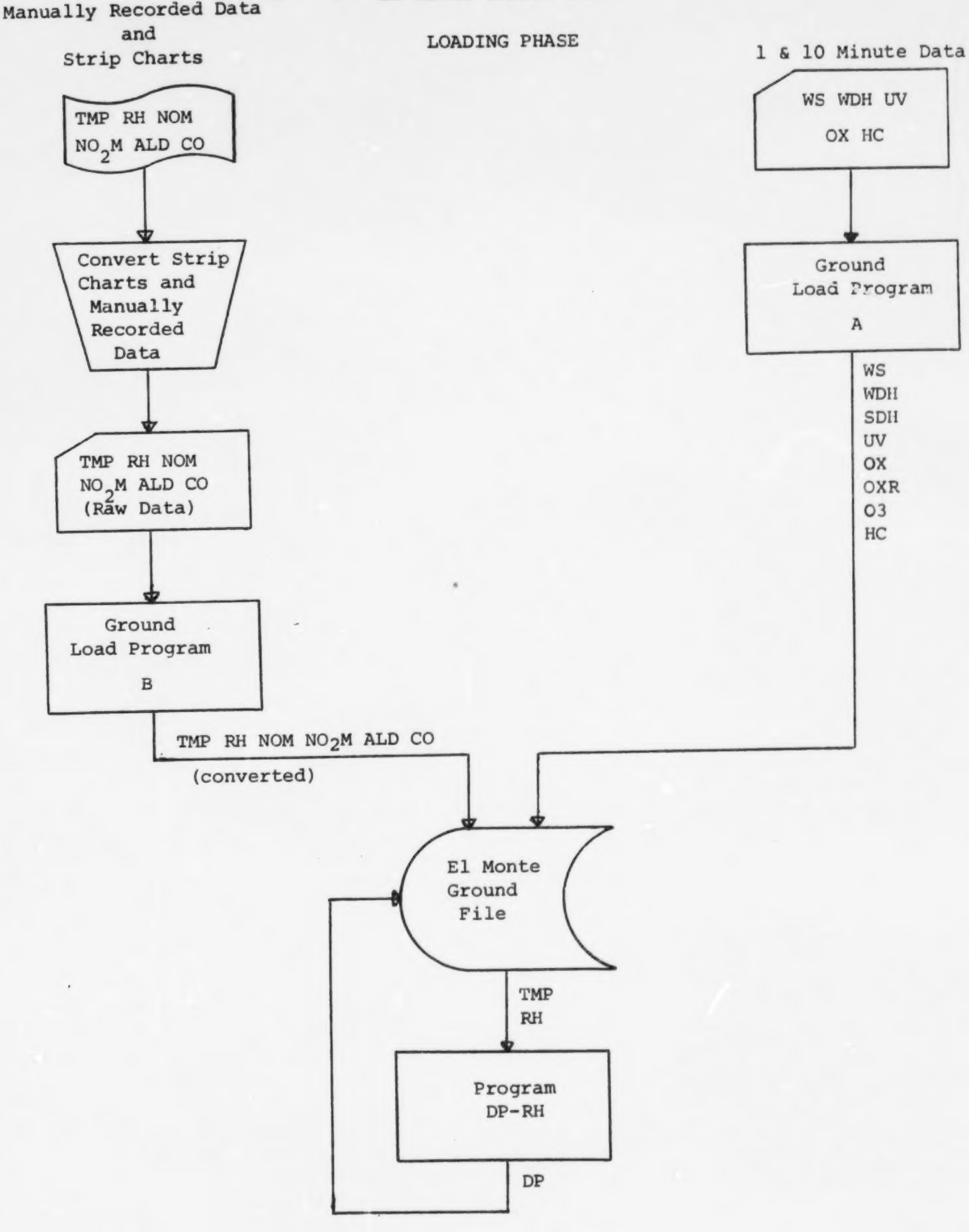
For El Monte the procedure (Figure 2-3) was basically the same as that described above for Commerce except that fewer variables were monitored by the data logger and consequently more strip chart data had to be used in the El Monte ground file. At El Monte, the inputs to Ground Load Program A were wind speed, horizontal wind direction, ultraviolet radiation, output from Mast Oxidant Recorder and total hydrocarbons. Ground Load Program A then processed these data as described above to produce ten minute averages of wind speed, horizontal wind direction, standard deviation of horizontal wind direction, ultraviolet radiation, total oxidant, residual oxidant, ozone, and total hydrocarbons.

For El Monte, the strip chart data read and processed through Ground Load Program B included temperature and relative humidity. The nitric oxide, nitrogen dioxide, and total aldehydes measured manually were calculated as described above. The carbon monoxide peaks were measured manually and calculated and stored by Load Program B.

Program DP-RH then took temperature and relative humidity and calculated the dew point using accepted psychometric equations.

Figure 2-3 EL MONTE GROUND FILE

LOADING PHASE



PRINTOUT OF GROUND FILES

A printout of the ground files was then obtained from the Ground Print Program as shown in Figure 2-4. From this printout, gaps in the data were identified and if the period appeared significant, strip charts were read, keypunched on cards and loaded into the ground files by Ground Load Program B. Erroneous data caused by equipment malfunction, voltage surges and operator error were identified. Using the date and time of the erroneous data and a cross reference to locations in the ground file, the file locations were keypunched on cards. Program Erase then destroyed the erroneous data entries in the ground file.

At this point the files were complete. Ground Print Program then produced the final printout and a file dump to binary cards was accomplished to document the completed file (Figure 2-5).

The Data Summary Program was then used to obtain a concise representation of important parameters from the large volume of data contained in the two ground files. For any three variables and for each day, the Data Summary Program calculated and printed for each selected parameter: the maximum and minimum point, the maximum and minimum one hour average and the beginning time of each, the maximum and minimum eight hour averages and the beginning time of each, and the twenty-four hour average. The restriction applied was that two-thirds of the total possible data points must be present in order to represent one and eight hour averages.

AIRCRAFT FILES

The procedure for generation of the airborne files is illustrated in Figure 2-6. The cards containing the continuously recorded parameters in the aircraft profile program contained the following parameters:

Figure 2-4 COMMERCE AND EL MONTE GROUND FILES EDIT PHASE

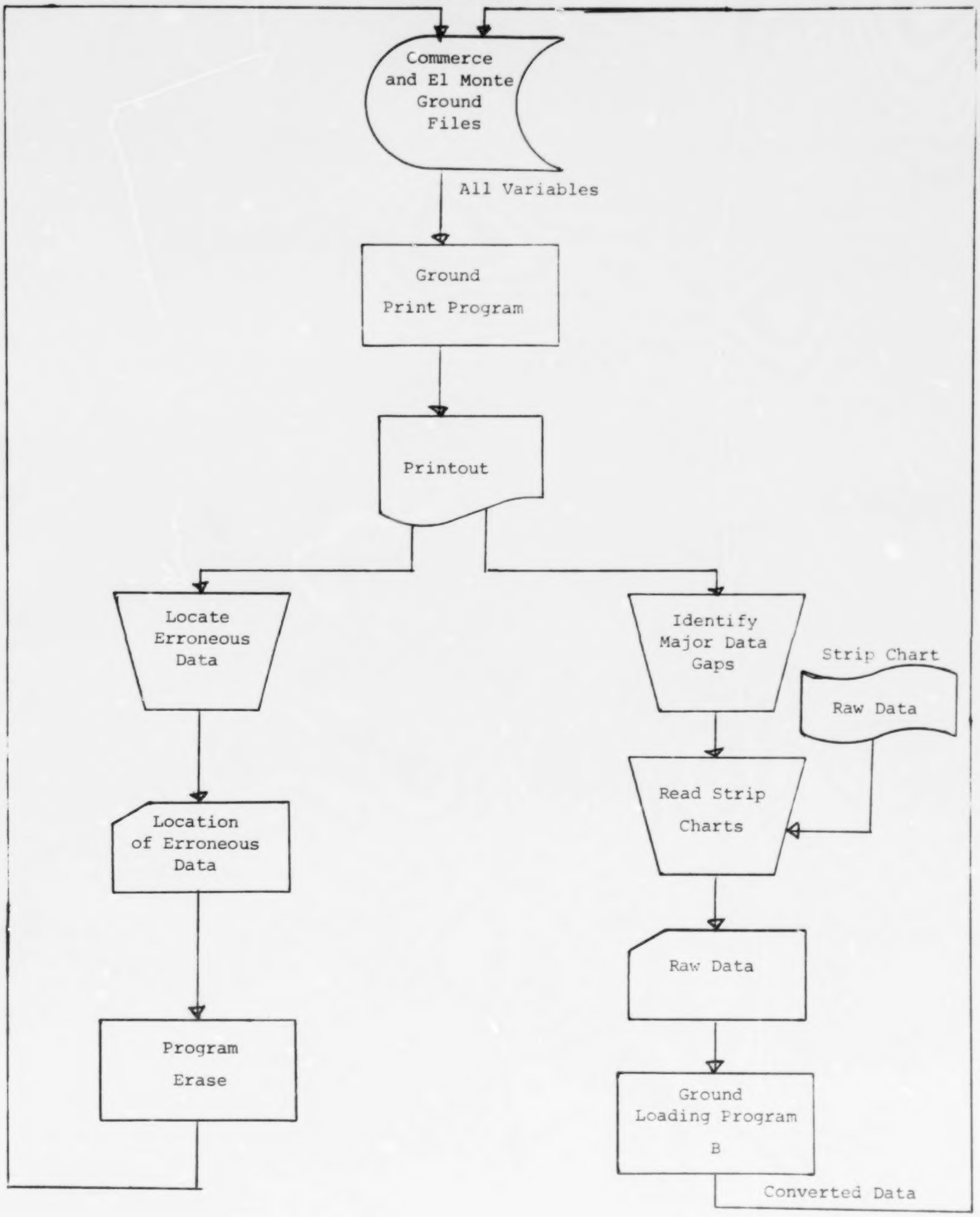


Figure 2-5 COMMERCE AND EL MONTE GROUND FILES

FINAL PROCESSING PHASE

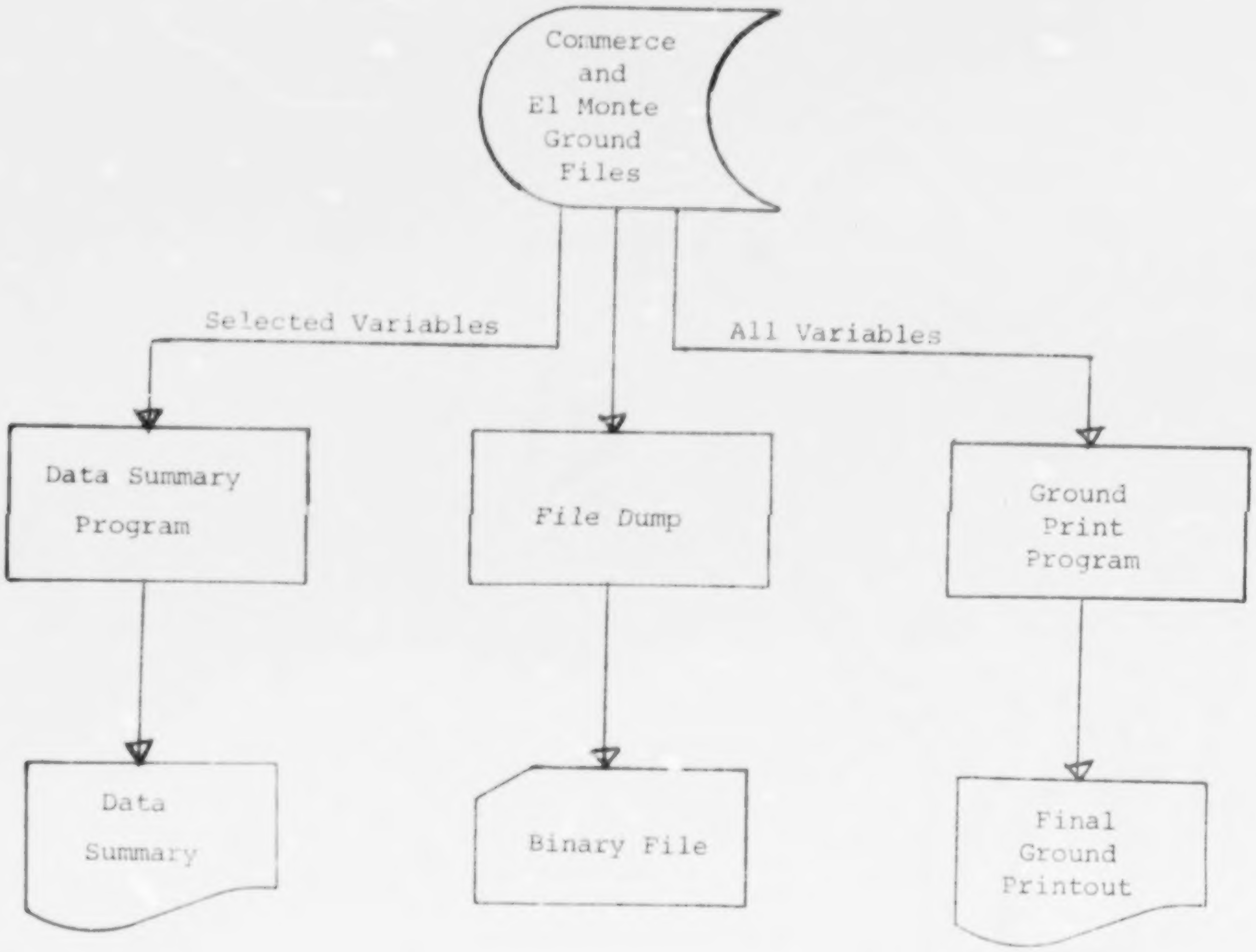
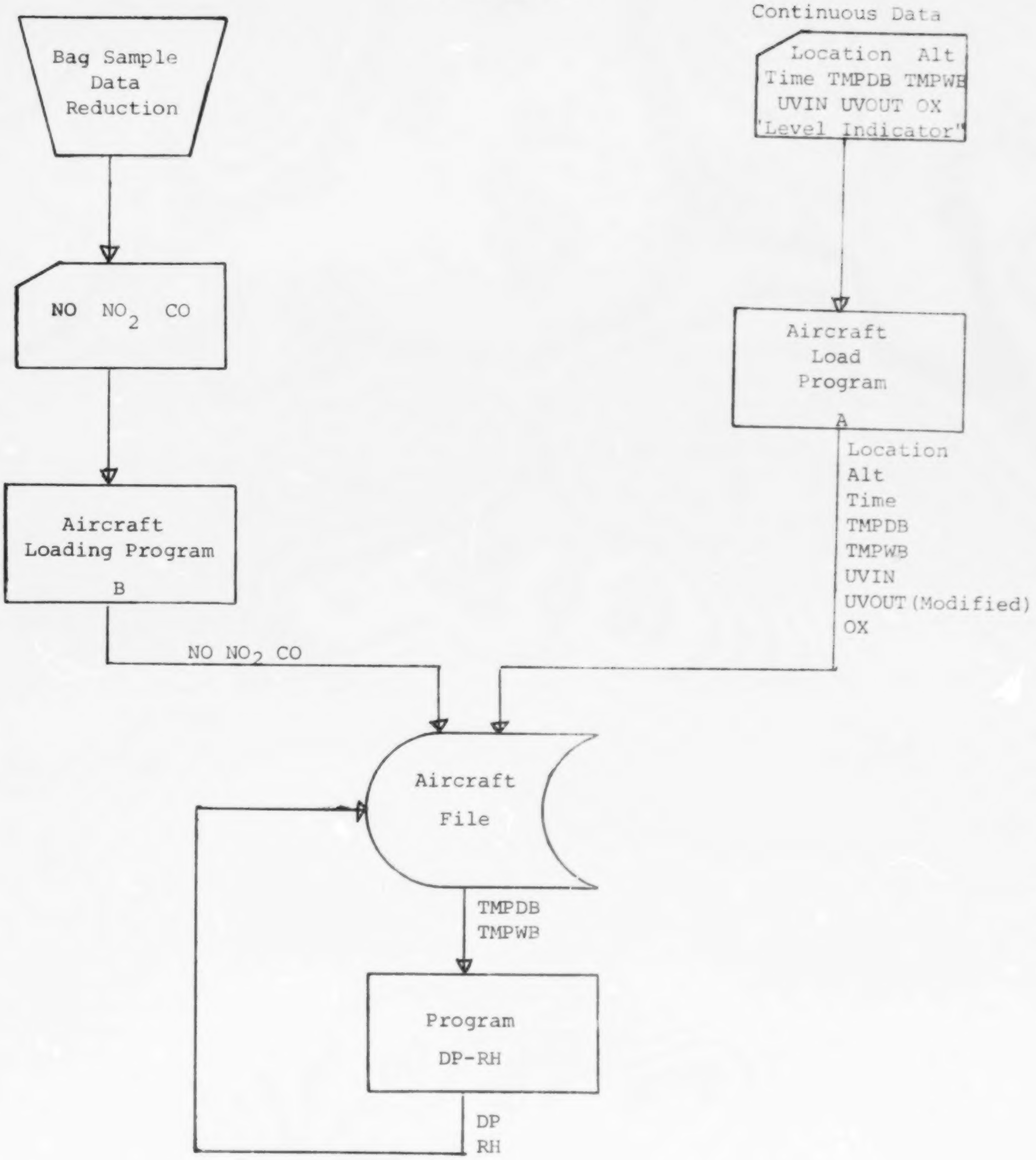


Figure 2-6 AIRCRAFT FILE

LOADING PHASE



location code, altitude from altitude transducer, time, dry bulb temperature, wet bulb temperature, ultraviolet radiation "in", ultraviolet radiation "out", total oxidant, and a level indicator which was present when the aircraft was in horizontal position. The Aircraft Load Program A stored these data in continuous fashion in the Aircraft file. The ultraviolet radiation was marked whenever the level indicator was present.

The nitric oxide, nitrogen dioxide and carbon monoxide data were obtained from analysis of the bag samples and keypunched on cards. Aircraft Load Program B then located these data into the appropriate time slot of the Aircraft file by comparison to a master bag sample-file location table.

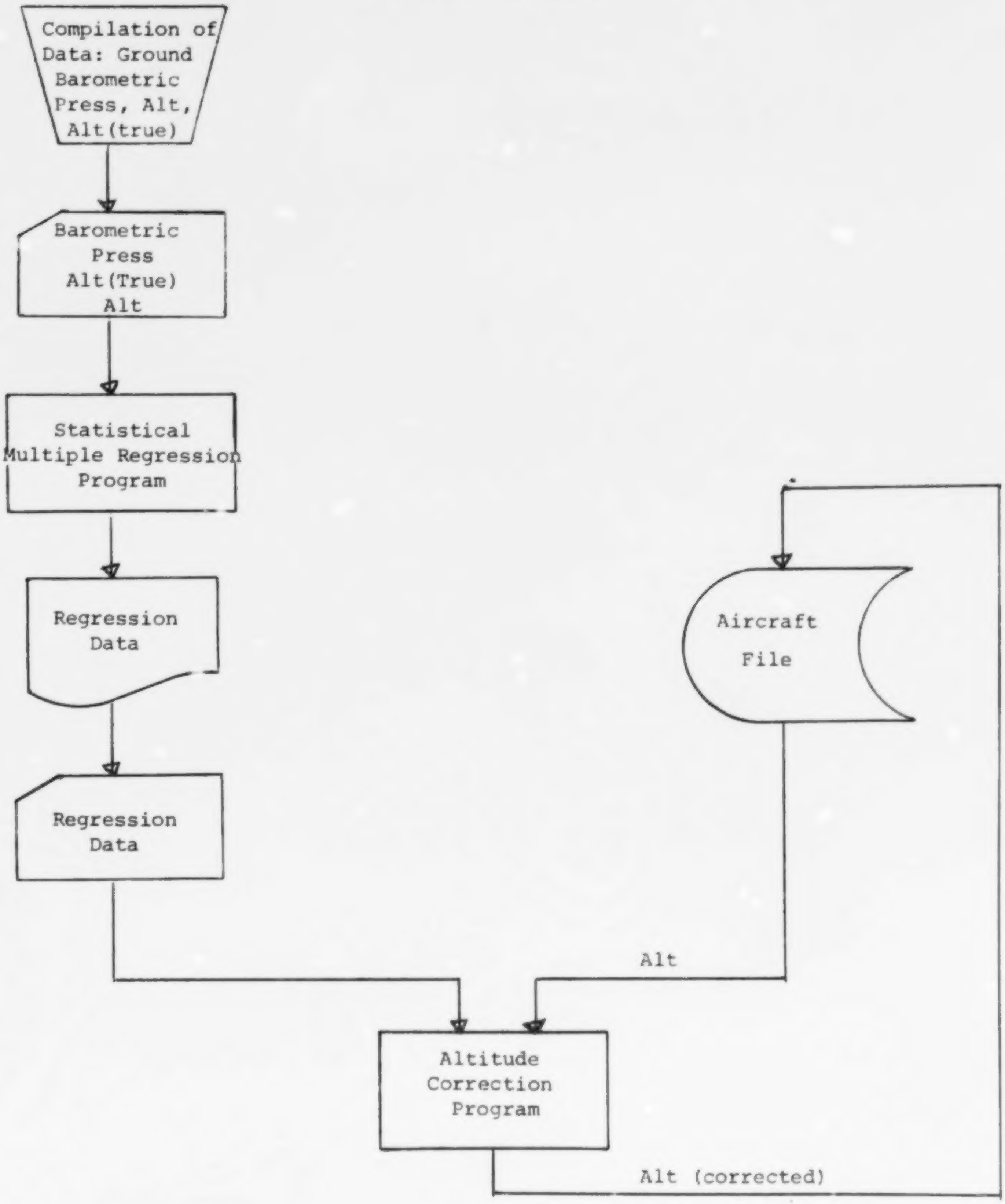
Program DP-RH was used to calculate and store the dew point and relative humidity from the dry and wet bulb temperatures in the Aircraft file.

The altitude transducer used to obtain the altitude reading in the aircraft was highly sensitive to barometric pressure especially at low altitude. The correction equations provided by the manufacturer were not adequate to correct the instrument error. Data was therefore compiled manually from existing flight records and keypunched on cards (Figure 2-7). A statistical multiple linear regression program was used to obtain the regression coefficients and the intercept necessary to correct the reading from the altimeter transducer to more evenly agree with the aircraft altimeter. Although the equations obtained are not worthy of mention since they are only valid for this one instrument, the degree of correlation is since it indicates how reliable the transformation was. At 800 feet and below the correlation coefficient was .979 and above 800 feet it was .997.

The Altitude Correction Program then took the resulting equations

Figure 2-7 AIRCRAFT FILE

ALTITUDE CORRECTION


Compilation of Data: Ground Barometric Press, Alt, Alt(true)
Barometric Press Alt(True) Alt
Statistical Multiple Regression Program
Regression Data
Regression Data
Aircraft File
Alt
Altitude Correction Program
Alt (corrected)

and calculated a new altitude which was in turn stored back in the Aircraft file.

The Aircraft Print Program (Figure 2-8) was used to obtain a printout of the file. The location of erroneous data was keypunched on cards. From this, the bad data was edited from the file by Erase Program.

At this point, the Aircraft File was complete. The Aircraft Print Program (Figure 2-9) produced the final printout and a binary dump was taken of the Aircraft File for documentation.

BALLOON FILE

The procedure for the balloon data is shown in Figure 2-10. The one and ten minute balloon data reduced from magnetic tape were in raw voltage form. The Balloon Load Program produced the 10 minute averages of the voltage recordings and stored them contiguously in the Balloon file along with the appropriate date and time.

The calibration curves and tables provided by the manufacturer to convert from voltages to engineering units were reduced and keypunched on cards. The Variable Calculation Program took the existing data in the balloon file and converted it with the calibration data into the meaningful parameters of temperature, relative humidity, horizontal wind speed and vertical wind speed. These variables were then stored back in the Balloon file.

Program DP-RH took the temperature and the relative humidity from the Balloon file and calculated the dew point using accepted psychometric equations (Figure 2-11).

The Balloon Print Program was then used to obtain a print-out of the existing file. After locating erroneous data points and keypunching

Figure 2-8 AIRCRAFT FILE

EDIT PHASE

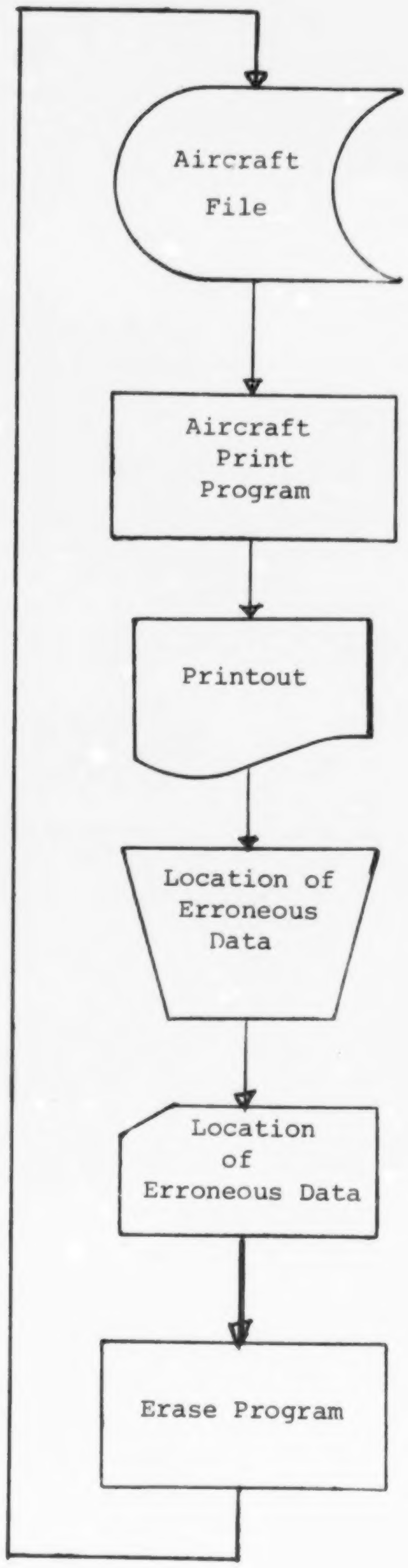


Figure 2-9 AIRCRAFT FILE

FINAL PROCESSING PHASE

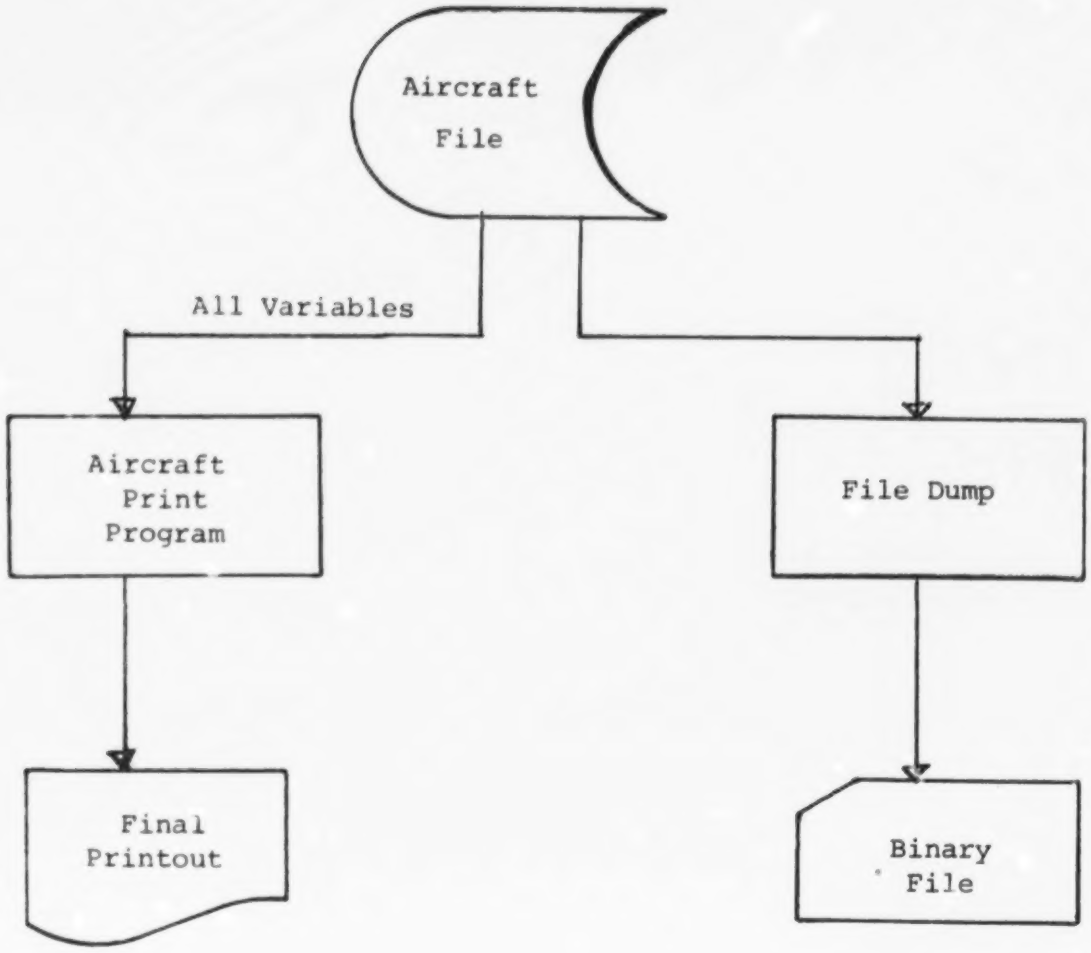


Figure 2-10 BALLOON FILE

LOADING PHASE

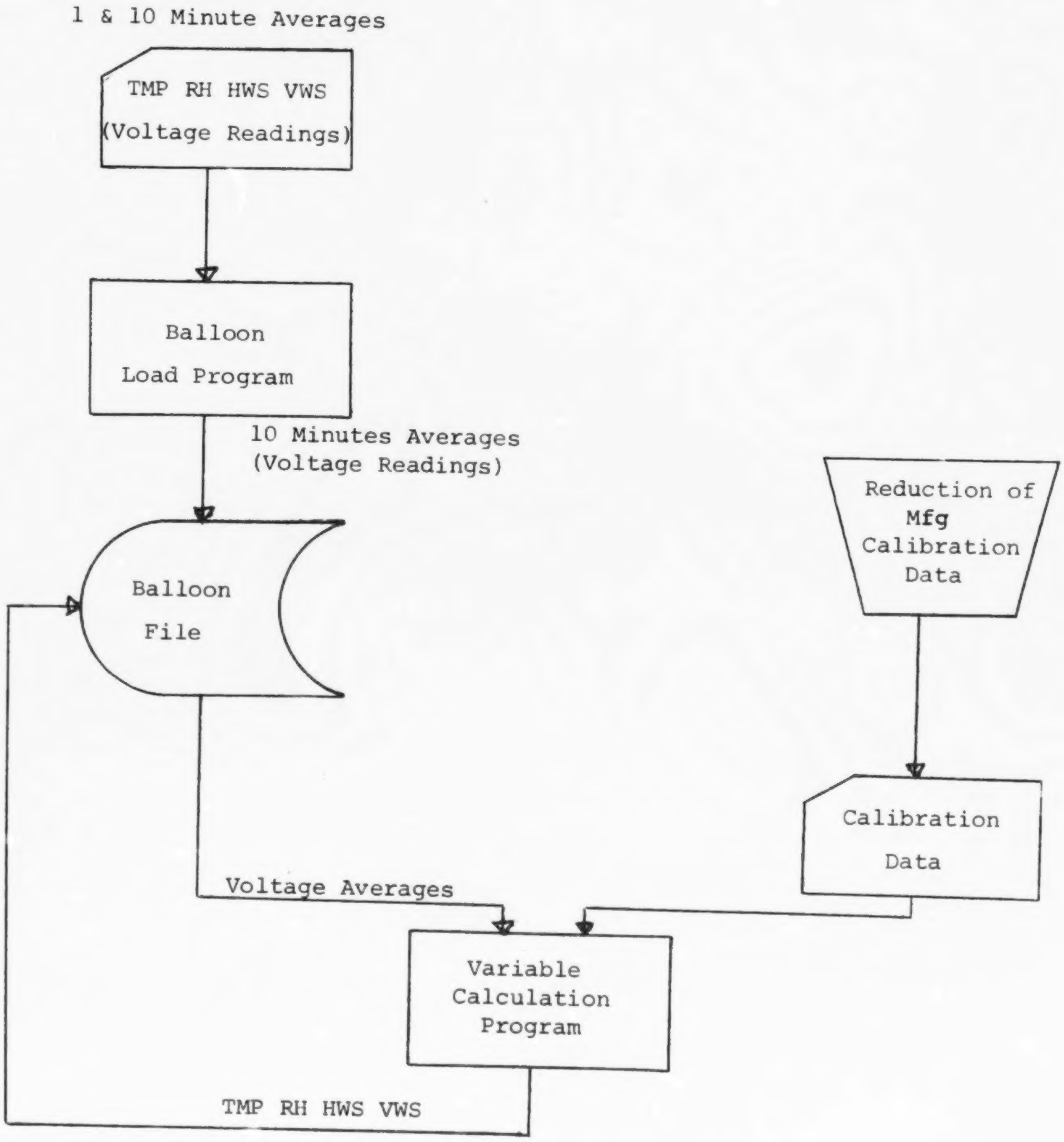
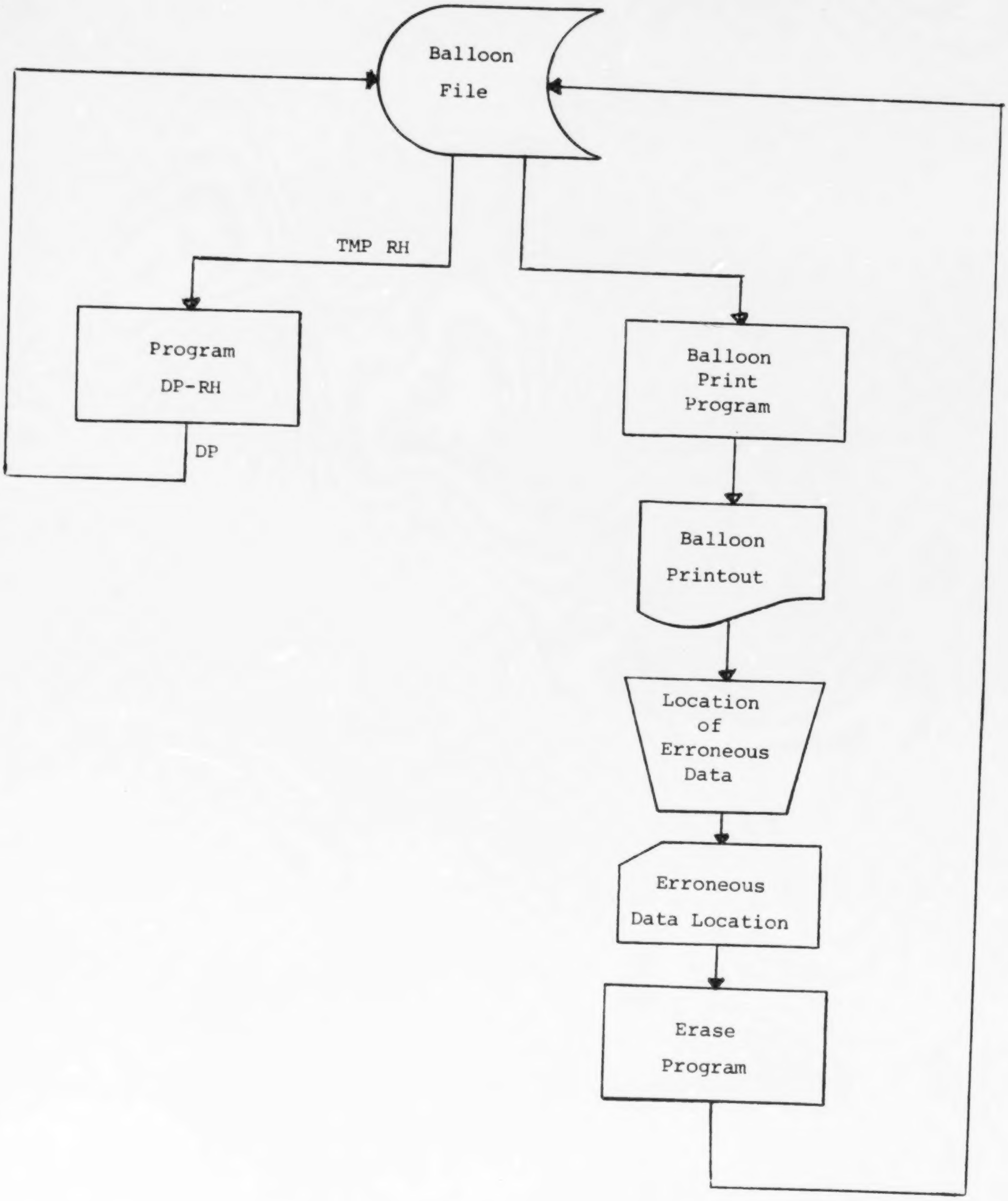


Figure 2-11 BALLOON FILE

PROCESSING AND EDIT PHASES



the location on cards, the Erase Program was used to edit out the bad data.

At this point, the Balloon file was complete. The Balloon Print Program produced the final print-out and a file dump was teken of the completed file for documentation (Figure 2-12).

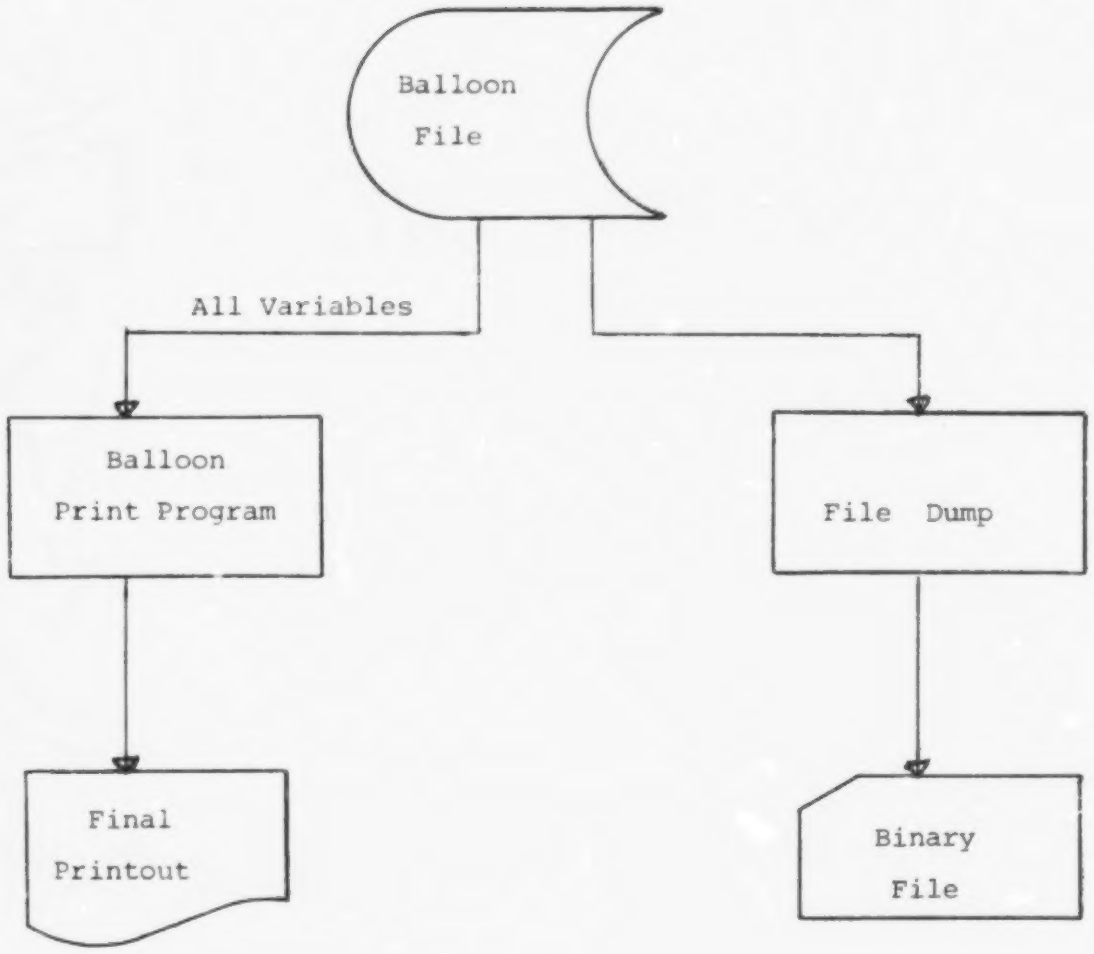
2.11 PROCESSING OF THE INDIVIDUAL C_1 TO C_{10} HYDROCARBONS

The peak heights and widths for the C_1 to C_4 hydrocarbons were obtained by manual measurement of the chromatographic peaks. These, along with the appropriate calibration factors and identification, were punched on cards. The sample concentrations were then computer calculated, edited, and stored in the appropriate data file.

The punched tape output of the C_5 to C_{10} chromatographic system was processed by computer. The program (Figure 2-13) read the paper tape, verified the identification header, and either adjusted for daylight time or, in the case of the airborne bag samples, assigned appropriate dates, times, and altitudes by referencing the bag sample numbers. It then made any necessary adjustments to accomodate variations in the peak retention time, identified each sample peak by comparison to a master file of peak numbers and retention times, and calculated the concentrations of the 109 peaks per sample on a ppb basis. The resultant sample concentrations were then stored in their appropriate data file. The 120 individual C_1 to C_{10} hydrocarbon concentrations produced by each sample were then summed and both the total and individual concentrations printed. Binary dumps of the completed files were then made.

Figure 2-12 BALLOON FILE

FINAL PROCESSING PHASE



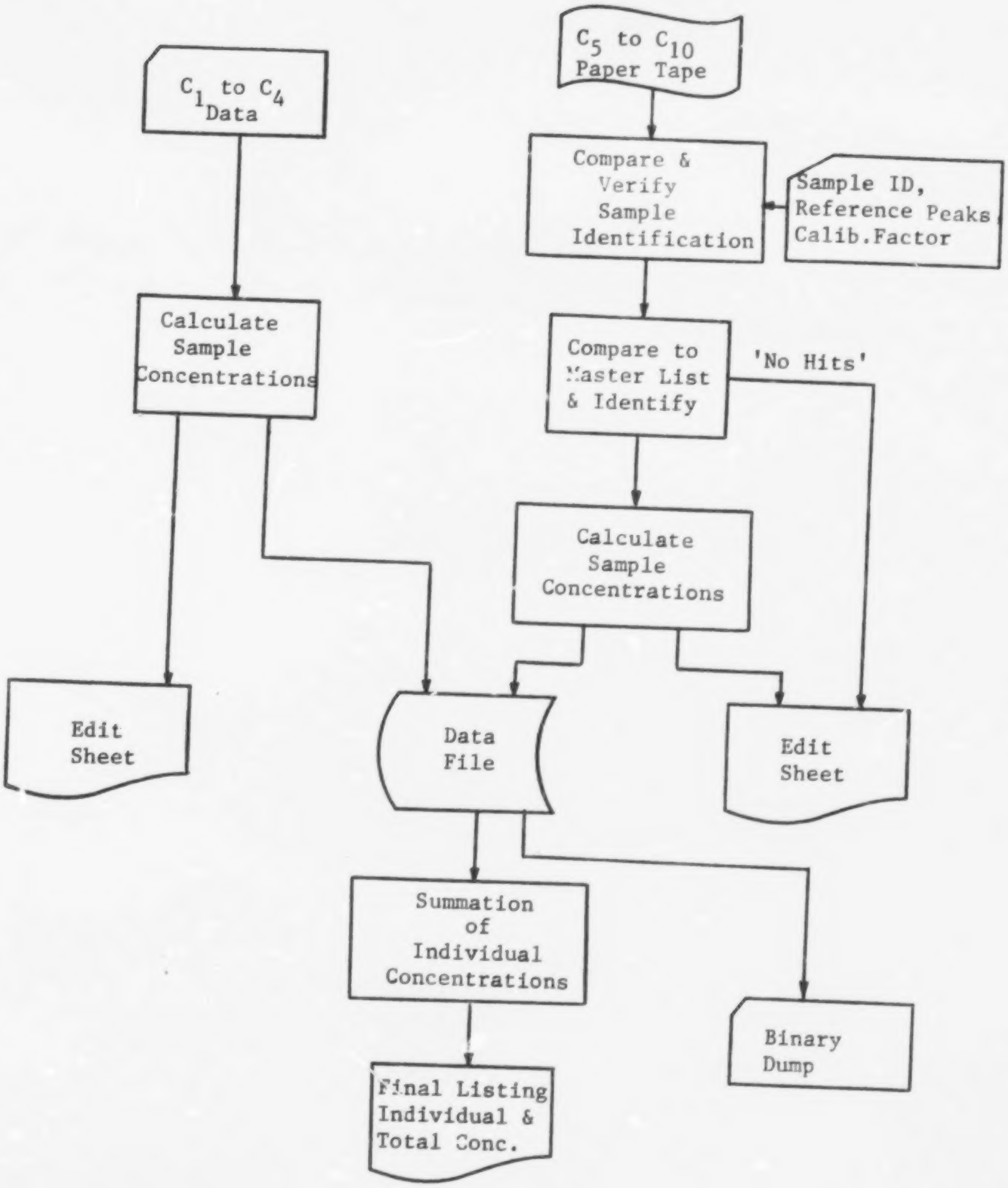

C_1 to C_4 Data
C_5 to C_{10} Paper Tape
Compare & Verify Sample Identification
Sample ID, Reference Peaks, Calib.Factor
Calculate Sample Concentrations
Compare to Master List & Identify
'No Hits'
Calculate Sample Concentrations
Edit Sheet
Data File
Edit Sheet
Summation of Individual Concentrations
Binary Dump
Final Listing Individual & Total Conc.

Figure 2-13

PROCESSING PROGRAM FOR C_1 TO C_{10} INDIVIDUAL HYDROCARBONS

3. PROGRAM DESIGN AND OPERATIONS

The field operations program was designed to obtain comprehensive aerometric data at two ground level sites on a minimum of 60 weekdays and two weekends during the period August 1 to November 14, 1969. Airborne measurements to establish vertical gradients above the ground sites were to be obtained on from 12 to 20 days during the period. Cooperation with an ESSA research program was to include analysis of Tedlar bag samples collected aloft by ESSA personnel during a two week period between September 15 and October 15, 1969.

3.1 TEST SITES

The criteria for selection of ground level sites were that the sites be along reasonable air trajectories into the Azusa area, and that one site be at or near an airport to facilitate transfer of airborne samples. It was also desirable that one site be in the area where morning pollutant concentrations were high and the other site be in an area where high oxidants were frequently recorded.

These criteria were met by setting up the government trailer in the USPHS Motor Vehicle Compliance Section Field Laboratory at 4545 East Washington Boulevard in the city of Commerce and the Scott trailer at the El Monte airport. These two sites were situated 10 miles apart, and the Commerce site was located such that a 240° wind would carry its air parcel to the El Monte site. This corresponded well with the prevailing late morning and afternoon wind direction on high oxidant days.

3.2 TEST PROGRAM AT GROUND SITES

It was desirable to follow the composition of an air mass from the time its pollutant components were emitted until the photochemical products formed passed their peak. Therefore, periodic sampling and analysis at Commerce was carried out from 0500 to 1400 PST, and at El Monte it was conducted from 0700 to 1600 PST. After October 26 the periods were one hour later. This enabled us to follow the pollutant buildup at Commerce which usually reached its peak between 0700 and 0800 PST and to thoroughly cover the oxidant maximum which was usually recorded between 1130 and 1300 PST at Commerce and between 1230 and 1400 PST at El Monte.

Samples for individual hydrocarbon analysis were taken at one hour intervals as this represented the time needed to analyze the sample and cool the chromatograph to the starting temperature of $-75^{\circ}C$. Nitrogen dioxide and nitric oxide determinations were made at 10 minute intervals during the early to mid-morning period when most of the nitric oxide was converted to nitrogen dioxide. The analysis of data from the 1968 program had shown that hourly or half hourly data points were not adequate for determining accurate reaction rates for the nitric oxide conversion because of rapid changes in concentration due both to reaction and atmospheric dilution. Total aldehydes were determined at one hour intervals.

3.3 AIRBORNE PROGRAM

On days when moderate to heavy smog was forecast, aircraft flights were scheduled for morning, noon and early afternoon so as to provide atmospheric profiles and air quality data during the following time periods: 0800-1000, 1100-1300, and 1400-1600 (local time). At all times when climbing or descending the aircraft was leveled in pitch and roll at 700 feet MSL, 1000 feet and at each 500 foot interval thereafter up to maximum flight altitude in order to make ultraviolet flux measurements. Other parameters, including total oxidant, dry-bulb temperature, wet-bulb temperature, and altitude, were monitored continuously.

The flight plan, which is illustrated in Figure 3-1, consisted of take-off from El Monte airport and spiral climb to 500 feet above haze top over El Monte, thence to Commerce arriving at Commerce above the haze top. A spiral descent was then made to 700 feet MSL (approximately 500 feet above terrain) over Commerce where bag samples for NO_x and hydrocarbon analyses were collected. A spiral climb was then performed, still over the Commerce site, stopping to sample at 1000 and 1500 feet MSL. The climb was continued until reaching 500 feet above the haze top. The ground sites were notified of the approach of the aircraft by radio so that simultaneous samples could be collected at ground level and aloft.

The aircraft was then flown at 2500 feet altitude south to the intersection of the Los Angeles and Rio Hondo rivers, passing safely under the track of airliners inbound to Los Angeles International Airport. A turn was made to the West and climb initiated, if necessary, in order to arrive over the Hawthorne Airport area above the haze top. A spiral descent was made over Alondra Park down to 1000 feet MSL, the pattern altitude for Hawthorne, followed by a full stop landing at the Hawthorne Airport. Ground time at Hawthorne was kept to the minimum required for taxi back to the runway for take-off. Climb out from Hawthorne was made to the south until reaching Alondra Park where a spiral climb to 500 feet above the haze top was made.

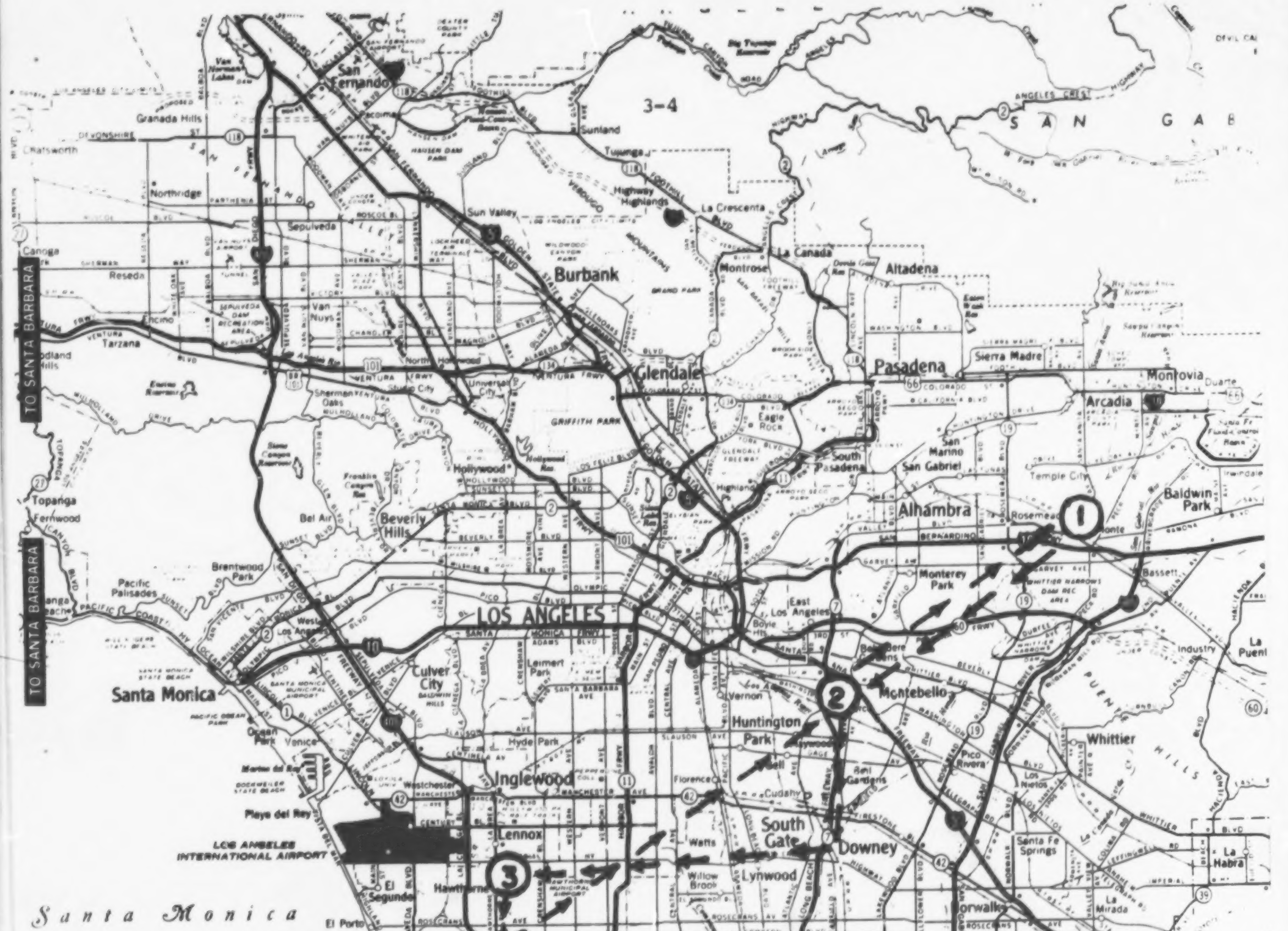


Figure 3-1 Aircraft Flight Plan

The aircraft then returned to Commerce where the eariler profile was repeated and air samples were collected at 700 feet MSL. The aircraft then climbed enroute to El Monte arriving at El Monte above haze top.

At El Monte a spiral descent to pattern altitude of 1100 feet MSL was performed collecting air samples at 1500 and 1100 feet. The aircraft was flown in the landing pattern until reaching 700 feet MSL on final approach where a wave-off manuever was performed overflying the airport at 700 feet MSL and collecting air samples. The aircraft then returned to the landing pattern and landed at El Monte. The crew dropped off the Tedlar sample bags for analysis and picked up supplies for the next flight. Total flying time was approximately 1.5 hours.

Deviations from this flight plan were made when special conditions warranted. When high oxidant levels were encountered, an aerial survey of oxidant concentration throughout the basin was made, mapping the oxidant concentration both in its vertical and horizontal extent. Smog fronts were encountered near Yorba Linda on two occasions. Air samples as well as continuous data were taken on both sides of the front while flying horizontal penetrations through the leading edge of the front.

3.4 COOPERATION WITH ESSA PROGRAM

An ESSA research program to investigate air trajectories and air quality was conducted in the Los Angeles area during September and early October. Scott cooperated in the study by providing Tedlar sample bags and analyzing the air samples collected in the bags for carbon monoxide, nitrogen dioxide, nitric oxide and C_1 to C_{10} hydrocarbons. The samples were collected from a helicopter flying in the vicinity of a tetroon (free balloon). Scott personnel contributed ground meteorological information and advice pertinent to tetroon launch times and sites and sampling locations, but all decisions regarding when and where to sample as well as the sampling itself were made by ESSA personnel.

Samples were received from ESSA during the period from September 19 to October 2. The analysis of these samples was performed during a second shift so that ground data could be taken during the daytime periods while ESSA was sampling aloft. All analyses for carbon monoxide and nitrogen oxides were done at El Monte while the individual C_1 to C_{10} hydrocarbon analyses were split between the ground sites so that they might be completed as soon as possible after they had been collected.

3.5 BALLOON PROGRAM

The planned acquisition of aerometric data from aloft through the use of tethered balloons (Kytoons) was curtailed because of FAA insistence that the requirements of Regulation 101 be strictly followed. The large number of helicopters traversing the area and the unfortunate accidents which occurred in recent years have made them very leery of permitting unmanned objects in the air lanes. However, permission was received from FAA to fly the instrumented aircraft as low as 500 feet above ground at Commerce as opposed to the normal restriction of 1500 feet in built-up areas. This allowed us to collect data and samples at points which had been originally assigned to the balloon program.

The balloon instrumentation was flown at the maximum allowable altitude of 150 feet above ground during the normal working day for most of the period after the ESSA program was completed. The balloons were flown over a vacant section of the railroad yard adjacent to Commerce laboratory. The horizontal distance from the balloon to the trailer was approximately 200 feet. In addition to the more than 300,000 meteorological data points recorded, valuable experience was gained in the use of the balloons and instrumentation package. This will enable an evaluation of the potential of this equipment in future aerometric studies.

4. DESCRIPTION OF DATA FILE

The data obtained from the 1969 program are presented in Volumes II, III and IV of this report. A total of nearly 500,000 reduced data points are included in the three volumes.

The data for the Commerce ground site contained in Volume II covers the period August 18 to November 14. The first section includes 10 minute averages for a total of 9 meteorological and 8 chemical parameters. The chemical parameters measured continuously were total oxidant (2 instruments), ozone, residual oxidant, nitric oxide, nitrogen dioxide, total hydrocarbons and carbon monoxide. Total aldehydes, nitric oxide and nitrogen dioxide were also measured periodically by manual procedures. The meteorological parameters include temperature, dew point, relative humidity, wind speed, horizontal wind direction, vertical wind direction, the standard deviations of each direction parameter, and ultraviolet radiation intensity. All were monitored with continuous instruments except relative humidity and the deviations of direction which were calculated from the appropriate data.

The second section of Volume II data shows the concentrations of more than 100 C_1 to C_{10} hydrocarbons determined by gas chromatographic analysis of 293 samples collected at Commerce. The final section contains ten minute averages for 5 meteorological parameters measured or calculated from data received from a telemetry unit attached to a tethered balloon 150 feet above the ground. The total number of reduced data points reported from the Commerce site exceeds 200,000.

The data for the El Monte ground site contained in Volume III is similar to that for Commerce. It covers the period August 18 to November 7.

The first section includes averages for 7 meteorological and 9 chemical parameters. The chemical parameters measured continuously were total oxidant, ozone, residual oxidant and total hydrocarbons while those measured periodically were total aldenydes, nitric oxide, nitrogen dioxide and carbon monoxide. Except for vertical wind direction and its standard deviation which were not measured at El Monte, the meteorological data given are identical to those at Commerce. The second section of Volume III presents data for C_1 to C_{10} hydrocarbons in 229 samples analyzed at El Monte. The total number of data points for El Monte exceeds 150,000.

The airborne data presented in Volume IV covers 26 flights on 15 days between September 10 and November 4. The first section includes readings for eight parameters at 10 second intervals during vertical profiles at El Monte, Commerce and Hawthorne and at 1 minute intervals for other points in the flight. The parameters include altitude, dry bulb temperature, wet bulb temperature, relative humidity, dew point, incoming ultraviolet radiation intensity and outgoing ultraviolet radiation intensity. The data for nitric oxide, nitrogen dioxide and carbon monoxide acquired by analysis of bag samples are listed in the profiles at the points the samples were collected. The second section of airborne data presents the concentrations of C_1 to C_{10} hydrocarbons found in 128 bag samples collected aloft and analyzed at the two ground sites. The total number of airborne data points exceeds 80,000.

The final two sections of Volume IV present the data derived from the ESSA cooperative program in which 110 Tedlar bag samples were collected aloft by ESSA and analyzed by Scott at the ground sites. ESSA furnished data for the time, altitude and location at which each sample was taken along with the ambient oxidant reading. Data generated by Scott included concentrations of nitric oxide, nitrogen dioxide, carbon monoxide and C_1 to C_{10} hydrocarbons.

5. EVALUATION OF INSTRUMENTATION AND PROCEDURES

5.1 SAMPLING SITES AND LOCATIONS

The ideal point at which the atmosphere should be sampled is dependent on the use to which the resulting data is to be applied. For example, if it is desired to determine the degree of exposure of pedestrians to certain pollutants, sampling would be done at face level along a busy sidewalk. In the case of our atmospheric reaction studies program the problem of sampling location becomes more complex. We are interested in following the changes which take place in an air mass from the time before photochemical reactions are initiated until well after peak concentrations of photochemical products have been reached. We would prefer to sample from a homogeneous mixture, but we must collect morning samples in areas with high contaminant emission rates where mixing is relatively poor. The low winds and inversion heights which produce atmospheric stagnation also lead to non-homogenuity because contaminants remain near their sources. We are also restrained by logistical considerations.

The sites selected for the 1969 program proved to be satisfactory and within expectations. The El Monte airport site was in the area to which the high early morning contamination from downtown Los Angeles was transported and high oxidant and other photochemical products were a frequent afternoon occurrence. The transfer of samples collected aloft was most convenient. There appeared to be no major sources of contaminants in the immediate area so the air mass was well mixed at most times. On the other hand, the site at Commerce was within two blocks of a freeway and in an industrial area. While no industrial stacks were very close to the site, the changes in hydrocarbon composition noted as the wind shifted indicated a variety of sources with poor morning mixing. Nevertheless, the physical advantages of the site and the fact that there is probably no area downtown over which there is good atmospheric homogenuity made the Commerce site a wise selection.

The vertical location of the sampling point must also be considered. We are interested in measuring reaction rates throughout the air mass under the inversion. Theoretically we should use a giant-sized version of a sampling probe used to traverse industrial stacks. For practical purposes we must settle on a point accessible to the ground site and be aware that a point too close to the ground may yield data in which the true reaction rates are masked by interactions with fresh emissions and changes in air currents.

The initial sampling point at Commerce, which was just above the building roof peak and 25 feet above the ground, proved unsatisfactory. The appearance of substantial concentrations of internally bonded olefins at mid-day when the oxidant was high and the presence of severe downspikes in the ozone traces indicated that large amounts of fresh emissions were reaching the sampling point at random times and the results were not at all representative of the air parcel over the site. It was believed that this was caused by random air currents carrying vehicular emissions from Washington Avenue up and over the building roof and the fact that the nearby Long Beach Freeway was elevated above ground to the approximate height of the sampling point. Additional tubing was added to raise the sampling point to 65 feet above ground. This helped to correct the problem, but did not entirely eliminate it. The periods of rapid fluctuation in air parcel composition are best illustrated by the instability of the strip chart records from the Mast Oxidant instrument.

The El Monte site was situated on a slight knoll and some distance from major emissions sources. Therefore, sampling a few feet above the roof of the trailer was quite satisfactory.

The wind sensors at both sites were positioned sufficiently high so as to avoid influence by ground objects. The usual meteorological guideline of twice the height of nearby obstructions was followed. A large billboard adjacent to the Commerce site made it necessary to position the sensors on a mast 75 feet above the ground while at El Monte the nearby airport beacon tower provided a suitable support for attaching the sensors at the 65 foot level.

The most desirable altitudes at which to collect airborne samples in order to best define vertical profiles is another complex problem. These are a function of the meteorological state of the profile which varies greatly from day to day and with time within each day. Since so little is known about vertical composition variations and no continuous instrument was available for monitoring contaminants aloft, much was left to the judgement of the engineer performing the airborne work. His decisions were based on visual and instrumental readings and the results from samples collected aloft on previous flights. We feel that the samples collected in the airborne program produced valuable information regarding this distribution and will provide a basis for even better sampling point decisions in future work.

5.2 MEASUREMENT OF CHEMICAL PARAMETERS

CARBON MONOXIDE

The Beckman Infrared Analyzer used to monitor carbon monoxide had a zero drift which averaged 1 to 2 ppm per day. The drift tended to be greater at times, and it was cumulative when not corrected daily. For example, the zero increased by 10 ppm from August 29 to September 1. The span was reasonably stable, while the background noise was approximately 1 ppm. Thus, the analyzer gave accurate results at higher concentrations when calibrated daily, but the data accuracy at concentrations less than 5 ppm frequently left much to be desired.

The Aerograph Chromatograph with helium ionization detector employed at El Monte performed very well, but it could only be used for periodic samples. Automation of this chromatograph to analyze samples on a 24 hour basis was considered, but was not carried out because the column must be purged overnight at frequent intervals to prevent loss of sensitivity through contamination of the detector cell.

TOTAL HYDROCARBONS

The Beckman Total Hydrocarbon Analyzer performed quite well at both sites. Unfortunately, the unit for the Scott trailer was damaged in shipment from the east and was not operational for the first month of the program. The units were calibrated at 20 ppm - carbon full scale deflection with a 10 millivolt output. The zero and span calibrations were very stable.

INDIVIDUAL C_1 TO C_{10} HYDROCARBONS

The Perkin-Elmer Chromatographs used to analyze for individual hydrocarbons by gas chromatography became inoperative on several occasions because of failure of the temperature programmers. This has been the only major source of trouble experienced with these instruments, but it has occurred periodically with both instruments since their purchase in July 1968. Fortunately, both units were never down at the same time so samples could be transported from one site to another and analyzed on a second shift to provide data continuity for both sites. The capillary column in the El Monte unit was replaced during the program when the peak resolution from the original column became unacceptable. The work conducted during Phase II of the 1968 program proved very beneficial in eliminating the contamination problem and other difficulties encountered in the 1968 field program. The Baymal column used for separation of the C_1 to C_4 hydrocarbons produced very good data except for the C_4 olefins which were masked by a baseline shift. However, the separation and sensitivity for all C_1 to C_3 hydrocarbons and the C_4 saturates was satisfactory.

The need for more accurate integrator counting of the small (<1 ppb) capillary peaks and for the identification of additional peaks remains. In addition, newly-developed substrates offer the possibility of more efficient separation of all C_1 to C_4 hydrocarbons. Thus, while the chromatographic procedure developed for this program has revealed for the first time a complete fingerprint of the hydrocarbons present in the Los Angeles Basin atmosphere, any greater refinement possible will be helpful in gaining a further understanding of the sources and reaction rates of atmospheric hydrocarbons.

NITROGEN OXIDES

The manual Saltzman procedure gave consistently good results at both sites. The multiple gas samplers built for this year's program made it possible to provide data points at ten minute intervals and to increase the sampling time as needed to develop sufficient color intensity for accurate values at low concentrations. The only problem was occasional plugging of the orifices which caused a decrease in sample flow rate.

The Beckman Acralyzer was modified by replacing the permanganate oxidizer with a more efficient solid dichromate oxidizer as explained in Section 2. This worked very efficiently although the dichromate oxidizer had to be replaced daily. Unfortunately the Acralyzer was plagued by problems in its electronics, solution pump, etc. for much of the program so that there was frequent disagreement between the manual and instrumental data. In most instances the manual data approximated that expected from comparison to other parameters such as carbon monoxide and hydrocarbons. The Acralyzer required more attention to keep operational than was practical with the available manpower. It appears that its delicate components and the sensitive pressure balance of its gas-liquid system combined with the complexity of check out and trouble-shooting procedures will permanently limit its utility.

OXIDANTS

The Mast Ozone Recorder and olefin titration apparatus performed admirably at both sites throughout the program. Except for the need to replace the solution pump in one unit, the two Mast instruments have been operational for the entire test periods in both 1968 and 1969. The titration apparatus constructed by Scott and operated on alternate 15 minute cycles, likewise performed perfectly throughout the period.

The Beckman Acralyzer for oxidants exhibited some of the same problems as the nitrogen oxides Acralyzers. Its zero drift was frequently greater than 5% of full scale per day. The instrument response was proportional to but greater than that of the Mast instrument. The difficulty of calibrating the over-all Acralyzer system on a regular basis in the field is a major drawback to obtaining maximum usefulness from the instrument.

PEROXYACETYL NITRATE

The automated Varian chromatographs with electron capture detectors performed satisfactorily for the determination of peroxyacetyl nitrate (PAN), but the minute concentrations normally present made the generation of numerical data next to impossible. It was anticipated based on previous measurements at UCR, Riverside that concentrations in the 10 to 50 ppb range would be found on high oxidant days. However, the concentration found at Commerce never exceeded 1 ppb and that at El Monte rarely exceeded 2 ppb with a maximum of 6 ppb on September 29. Other investigators had similar difficulties in detecting PAN in these areas. Some believed that the lower humidity in the Riverside area favors PAN formation.

The minimum detectable limits of PAN were approximately 1 ppb at Commerce and 2 ppb at El Monte where detector contamination caused a higher baseline noise level. Calibration was accomplished with a gas mixture supplied by Dr. E. R. Stephens of UCR. Daily sensitivity checks were made with a propyl nitrate mixture. Several other peaks were noted in many air sample chromatograms from both sites. Some varied with contaminant concentrations and others with oxidant, and all were consistently larger than the PAN peak. It was hoped that further identification work could be performed after the field program, but the chromatograph detector was severely damaged in shipment back to our Plumsteadville laboratory and replacement parts have not yet been received from the manufacturer.

5.3 METEOROLOGICAL INSTRUMENTATION

A number of time-consuming repairs and adjustments were necessary in order to make the meteorological instrumentation fully operational, but once this had been accomplished no major difficulties were encountered for the remainder of the program. The bivane which measured vertical wind direction at Commerce had a tendency to overshoot its maximum output of one volt during strong updrafts. Since the data logger recorded only the last three digits of the output, the final data are erroneous whenever the overshoot occurred.

The standard deviations of wind direction were calculated from the ten one minute averages in each data period. The relationship of this data to the true wind sigma which is measured continuously is not known nor is it known how meaningful the calculated deviations are.

5.4 AIRBORNE INSTRUMENTATION

The dry-bulb and wet-bulb instrumentation mounted on the aircraft had the fast response needed for profiles. This is demonstrated by the good agreement between up and down profiles made at Commerce. The Eppley UV Radiometers also performed well, although it must be remembered that the readings had full validity only when the aircraft was in horizontal flight as marked by an asterisk in the data files. The Mast Ozone Recorder had a response lag of 30 to 60 seconds and occasionally became temporarily inoperative after a rapid descent. However, it was quite rugged and well suited for use aloft.

The altitude transducer used in the aircraft could not be adjusted for changes in barometric pressure but had an error of approximately nine feet for each .01 inches of pressure change at ground level. It was also learned that the response departed from the standard calibration curve at low altitudes. Empirical equations to correct the recorded data were obtained from a linear regression analysis involving the altitude from the transducer, the true altitude at ground level and from the aircraft altimeter, and barometric pressure. The very high correlation and low residuals for the known data points indicated that the corrected altitudes listed in the data files are within 50 feet of the true altitude.

5.5 BALLOON TELEMETRY INSTRUMENTATION

The usefulness of remote instrumentation attached to a tethered balloon (Kytoon) was limited in the Commerice area by strict FAA requirements, strong radio frequency and industrial noise signal interferences, and light winds which limited the lifting power of the Kytoons. An antenna had to be installed on the roof of the building and pilots' voice transmissions were occasionally received on the speaker used to verify that the telemetry signals were being received. The telemetry units were rugged and lightweight. A malfunction in the receiver resulted in the loss of temperature data for the last week of the program, but the remaining three parameters continued to be received. It is known that the hygristors do not give reliable humidity data below 40% R.H., but the general accuracy of the data appeared quite good when compared to simultaneous ground data.

The use of balloon telemetry equipment has considerable potential in many areas, but we feel that a good deal of additional development will be required to overcome the limitations cited above so that the apparatus can achieve this potential in populous areas such as Commerce or downtown Los Angeles.

5.6 DATA LOGGERS

The Metrodata loggers offer a reliable means of recording 20 or more channels of data on magnetic tape. The loggers are versatile, rugged, light-weight and suitable for use on the ground or aloft. Most of the problems encountered initially were due to the fact that they were little past the prototype stage. The logger at Commerce became inoperative frequently and the logger moved from El Monte to Commerce also became inoperative after a short time. After extended discussion with the manufacturer it was decided that the cause of the failures was most likely high voltage surges which frequently occur for millisecond periods in industrial areas. The logger electronics were revised to protect it from these surges and no similar problems occurred over the remaining two months of the program.

The outputs of two of the instruments (total hydrocarbon and Mast oxidant) were 10 millivolts full scale. These were amplified to the normal 1 volt input required by the loggers through the use of preamplifiers attached to the loggers. The difficulty in obtaining a satisfactory electrical ground and the lengths of the conductor through which the millivolt signals passed from instrument to amplifier resulted in greater signal variation than was desirable. Amplifying the signals right at the instruments should correct this problem.

The potential of the data loggers seems vast. As further improvements and modifications are made their utility for recording a wide variety of raw data in a form suitable for computer processing should increase and greatly expedite data reduction processes.

6. SUMMARY OF GROUND DATA

A summary of the maxima and minima for six chemical parameters at each ground site are presented on pages 6-3 to 6-28. The daily averages and averages for the maximum and minimum one hour and eight hour periods for each day are shown in addition to the highest and lowest single readings. The time of day shown is that for the start of each period. In order to eliminate the influence of occasional erratic data points the criteria was set that a minimum average of four data points per hour were required for a time period to be considered as a maximum or a minimum period. This resulted in no data being recorded for certain days on which an insufficient number of points were available. The data shown for the continuously monitored parameters have a high degree of validity. However, since the periodic data was generally collected during the maximum period, the minima listed frequently do not represent the true minima for the 24 hour period.

The trend of higher contaminant concentrations at Commerce than at El Monte, but higher photochemical product concentrations at El Monte is clearly evident. This is readily explained by the additional photochemical reaction time as the polluted air passed from the downtown or Commerce area to El Monte. This is confirmed by the oxidant peak usually occurring 1 to 2 hours later at El Monte than at Commerce on high oxidant days. The maximum 1 hour oxidant was 37 pphm at El Monte and 21 pphm at Commerce. The maximum 1 hour averages for other parameters for Commerce and El Monte respectively were as follows: ozone - 16, 30 pphm; nitrogen dioxide - 43, 37 pphm; total nitrogen oxides - 111, 61 pphm; total hydrocarbons - 16, 17 ppm - carbon; carbon monoxide - 30, 26 ppm. Table 6-1 shows that the maximum 1 hour oxidant values did not vary greatly from one day of the week to another nor were they less on weekends than on weekdays. Likewise, the 1 hour maximum and 24 hour average concentrations of carbon monoxide exhibited no significant change among different days of the week.

Table 6-1. Daily Averages for Oxidant and Carbon Monoxide

	Max. 1 hr Oxidant, pphm		Max. 1 hr CO, ppm	24 hr Ave. CO, ppm
	Commerce	El Monte	Commerce	Commerce
Mon	5.8	12.8	12.2	6.1
Tue	6.5	13.7	12.7	5.3
Wed	7.7	17.0	11.4	4.9
Thu	7.8	13.8	9.9	4.2
Fri	6.6	11.5	11.3	4.9
Sat	8.8	12.4	10.2	4.8
Sun	8.8	11.2	12.0	5.6

The summary data on the following pages are arranged in the following order: Commerce oxidant, ozone and nitrogen dioxide; El Monte oxidant, ozone and nitrogen dioxide; Commerce carbon monoxide, total hydrocarbons and nitrogen oxides; El Monte carbon monoxide, total hydrocarbons and nitrogen oxides. The concentrations are given in parts per hundred million except for carbon monoxide which is in parts per million and total hydrocarbons which are in parts per million carbon.

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SCOTT RESEARCH LABORATORIES                   CPA70-611421113SR049                      RUN DATE 02/10/70-001
SUMMARY GROUND DATA                             08/18/69-08/31/69                                  COMMERCE


DAY                       OX                                        O3                                        NO2M
          H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX)  3.1  2.8-1020   2.0-0950  1.5  1.2  0.4-0950   0.1-1010  0.0 33.2 17.0-0740              9.4
   (MIN)  0.7  0.8-2210   1.0-1600  1.5  0.0  0.0-0710   0.0-1450  0.0  3.2  5.4-1450              9.4
TUE(MAX)  0.8  0.7-0000   0.6-0000  0.6  0.0  0.0-0000   0.0-0000  0.0 16.2 12.8-0900              8.5
   (MIN)  0.5  0.6-0050   0.6-0110  0.6  0.0  0.0-0000   0.0-0000  0.0  1.5  2.5-1450              8.5
WED(MAX)  1.7  1.6-1730   1.1-1550  1.1  0.0  0.0-1730   0.0-1550  0.0 21.6 17.0-1220             15.6
   (MIN)  0.7  0.8-2240   1.1-1600  1.1  0.0  0.0-1730   0.0-1550  0.0 10.4 13.5-1310             15.6
THU(MAX) 14.5 13.3-0950   7.8-0700  3.6 11.2 10.2-1000   5.2-0650  1.8 32.2 27.3-0940             19.3
   (MIN)  0.7  0.8-0450   1.0-0000  3.6  0.0  0.0-0000   0.0-0000  1.8  9.4 12.2-1310             19.3
FRI(MAX) 15.0 13.6-1020   6.6-0700  3.2 11.4 10.1-1020   4.0-0540  1.3 49.4 40.1-0900 24.1-0630 21.0
   (MIN)  0.8  1.0-2130   1.4-1600  3.2  0.0  0.0-0000   0.0-0000  1.3  5.2  8.0-1510 18.8-0820 21.0
SAT(MAX) 10.7 10.1-1410   6.5-0930  2.9  8.7  8.1-1400   4.5-0910  1.4
   (MIN)  0.8  0.9-0100   1.0-0000  2.9  0.0  0.0-0000   0.0-0000  1.4
SUN(MAX) 16.2 14.3-1210   8.2-0920  3.5 13.6 11.9-1210   6.5-0920  2.1
   (MIN)  1.0  1.1-0550   1.2-0030  3.5  0.0  0.0-0000   0.0-0000  2.1


MON(MAX)  4.8  3.8-1540   2.8-1340  1.9  2.1  1.1-1550   0.3-1350  0.1 16.4 10.2-0630  8.3-0300  8.0
   (MIN)  1.0  1.2-2210   2.4-1600  1.9  0.0  0.0-0000   0.2-1600  0.1  2.2  5.6-1120  8.0-0350  8.0
TUE(MAX)  7.1  6.3-1140   5.0-1000  2.9  5.1  4.3-1140   1.7-0740  1.0 11.6  9.2-1200              4.6
   (MIN)  1.0  1.1-0220   1.6-0000  2.9  0.0  0.0-0000   0.0-0000  1.0  1.0  1.7-0540              4.6
WED(MAX)  3.0  2.9-0750             2.4  0.0  0.0-0440             0.0 16.1 11.3-0510              7.8
   (MIN)  1.4  2.0-0500             2.4  0.0  0.0-0440             0.0  5.0  5.9-0630              7.8
THU(MAX)                                                                10.6  9.5-0810              8.5
   (MIN)                                                                 7.1  7.9-0710              8.5
FRI(MAX)                                                                14.6  7.5-0650              6.4
   (MIN)                                                                 2.4  5.2-0540              6.4
SAT(MAX)
   (MIN)
SUN(MAX)
   (MIN)
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SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA

CPA70-611421113SR049
09/01/69-09/14/69

RUN DATE 02/10/70-002
COMMERCE

DAY	OX				O3				NO2M			
	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR
MON(MAX)												
(MIN)												
TUE(MAX)	3.9	3.7-1520		3.4	0.0	0.0-1320		0.0	20.4	15.6-0830		11.8
(MIN)	3.1	3.3-1400		3.4	0.0	0.0-1320		0.0	6.4	9.7-0620		11.8
WED(MAX)	7.7	6.3-1520	4.3-1240	3.8	2.2	0.9-1520	0.2-1250	0.1	17.0	15.2-1010		8.5
(MIN)	2.7	2.9-2240	3.4-1600	3.8	0.0	0.0-1400	0.0-1550	0.1	3.0	5.3-0550		8.5
THU(MAX)	9.1	8.1-1050	6.2-0710	4.1	5.3	4.2-1100	1.9-0750	0.6	35.3	33.7-0850		16.4
(MIN)	2.4	2.7-0040	3.0-0000	4.1	0.0	0.0-0000	0.0-0000	0.6	7.7	9.5-0610		16.4
FRI(MAX)	6.0	5.8-1250	4.5-0840	3.5	2.2	2.0-1250	0.6-1100	0.2	20.9	17.4-0800		15.2
(MIN)	2.5	2.7-0240	2.8-0000	3.5	0.0	0.0-0000	0.0-0000	0.2	10.0	14.3-0710		15.2
SAT(MAX)	12.2	11.1-1120	7.3-0830	4.6	6.9	5.8-1130	2.7-0830	0.9				
(MIN)	2.4	2.8-0010	3.1-0000	4.6	0.0	0.0-0000	0.0-0000	0.9				
SUN(MAX)	7.9	5.5-1500	4.1-0800	3.5	4.5	1.9-1500	0.3-1100	0.1				
(MIN)	2.4	2.8-0430	3.1-0000	3.5	0.0	0.0-0000	0.0-0000	0.1				
MON(MAX)	9.4	9.1-1050	7.0-0630	4.3	5.0	4.8-1040	2.4-0630	0.7	16.0	14.5-0830		12.1
(MIN)	2.3	2.8-0210	3.4-1600	4.3	0.0	0.0-0000	0.0-1500	0.7	6.4	10.9-0720		12.1
TUE(MAX)	10.6	10.0-1240	8.7-0910	5.4	5.5	5.2-1410	3.3-0940	1.0	22.8	19.6-0840		11.5
(MIN)	2.6	3.0-0410	3.3-0000	5.4	0.0	0.0-0000	0.0-0000	1.0	0.0	6.0-0550		11.5
WED(MAX)	17.0	16.0-1020	11.4-0850	6.1	12.0	10.3-1020	6.9-0940	2.3	46.9	42.9-0830		27.2
(MIN)	2.0	2.0-2050	3.4-1600	6.1	1.0	0.3-1900	0.0-0000	2.3	9.3	13.5-0550		27.2
THU(MAX)	13.0	11.8-1040	8.2-0920	4.2	9.0	7.8-1040	5.0-1000	1.7	29.4	27.4-0830		17.9
(MIN)	1.0	1.0-2030	2.1-0000	4.2	0.0	0.0-0000	0.0-0000	1.7	9.9	10.7-0530		17.9
FRI(MAX)	8.0	7.0-1150	5.5-0950	3.3	5.0	4.0-1430	2.3-1100	0.8	23.6	14.2-0800		13.2
(MIN)	2.0	2.0-0000	2.1-0000	3.3	0.0	0.0-0000	0.0-0000	0.8	5.5	10.1-0640		13.2
SAT(MAX)	11.0	9.7-1220	6.5-0920	3.8	9.0	7.5-1220	4.1-0940	1.5				
(MIN)	2.0	2.0-0000	2.1-0000	3.8	0.0	0.0-0000	0.0-0000	1.5				
SUN(MAX)	6.0	6.0-1300	4.6-0930	2.9	4.0	4.0-1300	2.6-0930	0.9				
(MIN)	2.0	2.0-0000	2.0-0000	2.9	0.0	0.0-0000	0.0-0000	0.9				

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SCOTT RESEARCH LABORATORIES                     CPA70-611421113SR049                    RUN DATE 02/10/70-003
SUMMARY GROUND DATA                              09/15/69-09/28/69                                  COMMERCE


DAY                      OX                                      O3                                      NO2M
           H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)   5.0  4.7-1120  3.1-0920  2.4  2.0  1.7-1120  0.5-0920  0.2 11.5  8.0-0620             6.6
   (MIN)   2.0  2.0-0000  2.0-0000  2.4  0.0  0.0-0000  0.0-0000  0.2  3.1  5.5-0730             6.6
TUE(MAX)   7.4  6.8-1230  4.3-0900  3.0  3.8  3.1-1230  0.8-0710  0.3  6.5  5.7-0610             5.0
   (MIN)   1.9  2.0-0000  2.1-0000  3.0  0.0  0.0-0000  0.0-0000  0.3  3.4  4.8-0920             5.0
WED(MAX)  10.0  9.3-1210  5.5-0830  3.2  6.0  5.3-1210  2.2-0900  0.6 12.7 11.1-1010             7.6
   (MIN)   1.9  2.0-1710  2.2-1600  3.2  0.0  0.0-0000  0.0-0000  0.6  4.6  5.2-0730             7.6
THU(MAX)  10.2  9.1-1220  5.0-0700  3.4  5.7  4.7-1220  1.2-0700  0.4 10.7  9.4-0810             7.8
   (MIN)   2.0  2.0-0000  2.2-0000  3.4  0.0  0.0-0000  0.0-0000  0.4  5.6  6.6-0610             7.8
FRI(MAX)  14.9 12.5-1230  7.5-1010  4.4 10.2  8.8-1240  2.5-0810  0.8 10.8 10.1-0820             9.4
   (MIN)   1.0  2.0-2040  2.6-0000  4.4  0.0  0.0-0000  0.0-0000  0.8  7.1  8.5-0720             9.4
SAT(MAX)   6.3  5.8-1200  4.4-1110  3.1  3.9  2.8-1510  1.2-1300  0.6
   (MIN)   1.2  2.0-0240  2.5-0220  3.1  0.0  0.0-0020  0.0-0000  0.6
SUN(MAX)   8.4  7.7-1210  6.6-1110  4.0  5.3  4.8-1220  1.2-1400  0.7
   (MIN)   1.2  1.8-0230  2.3-0000  4.0  0.0  0.0-0000  0.0-0000  0.7


MON(MAX)   8.7  7.3-1110  5.2-0750  3.6  5.6  4.3-1110  2.5-0950  0.8 10.9  8.8-0830             7.3
   (MIN)   1.7  2.2-0240  2.6-0000  3.6  0.0  0.0-0000  0.0-0140  0.8  0.0  6.0-0930             7.3
TUE(MAX)   8.0  7.8-1140  5.8-1040  4.0  4.9  4.6-1140  2.4-1040  0.9 12.8  9.0-0620             7.3
   (MIN)   1.9  2.2-2040  2.7-0000  4.0  0.0  0.0-0000  0.0-0000  0.9  4.3  6.4-0710             7.3
WED(MAX)  12.4 10.7-1120  7.3-1050  4.7  8.9  7.2-1120  3.9-1100  1.6 17.9 16.2-0820            13.1
   (MIN)   1.8  2.4-0200  2.7-0000  4.7  0.0  0.0-0000  0.0-0000  1.6  9.9 10.7-0630            13.1
THU(MAX)  13.4 12.2-1110  6.9-0820  4.6  9.4  8.1-1110  3.2-0810  1.4 20.6 18.2-0910            13.7
   (MIN)   2.2  2.4-2240  2.7-1600  4.6  0.0  0.0-0440  0.0-1600  1.4  9.5 10.3-1100            13.7
FRI(MAX)   7.3  6.2-1420  4.6-0830  3.4  3.5  3.2-1420  1.1-1100  0.4 20.6 14.0-0840            13.0
   (MIN)   2.2  2.3-2020  2.7-1600  3.4  0.0  0.0-0000  0.0-0000  0.4  8.6 10.0-0650            13.0
SAT(MAX)  16.5 15.5-1230  9.3-0910  4.8 12.8 11.8-1230  5.9-0910  2.0 14.8 13.9-0830            12.2
   (MIN)   2.0  2.3-2230  2.5-0000  4.8  0.0  0.0-0000  0.0-0000  2.0  8.2 10.8-0600            12.2
SUN(MAX)  24.0 21.2-1120 13.3-1000  6.4 19.0 16.3-1120  9.4-1000  3.5 21.3 20.2-0910            16.9
   (MIN)   1.7  2.0-2250  2.5-0000  6.4  0.0  0.0-0000  0.0-0000  3.5 11.5 15.5-0720            16.9
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SCOTT RESEARCH LABORATORIES                        CPA70-611421113SR049                        RUN DATE 02/10/70-004
SUMMARY GROUND DATA                                  09/29/69-10/12/69                                      COMMERCE

DAY                           OX                                           O3                                        NO2M
           H/L  1HR-TIME   8HR-TIME 24HR  H/L   1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX) 14.3 12.2-1100   6.3-0700  3.7 10.9   9.3-1040   2.8-0700  0.8 40.6 39.2-0840 24.7-0340 22.4
   (MIN)  1.7  2.0-0230   2.4-0000  3.7  0.0   0.0-0000   0.0-0000  0.8  7.9  9.9-1200 22.4-0500 22.4
TUE(MAX) 17.9 15.6-1210   8.1-0840  4.5 14.9  12.7-1210   5.1-1100  1.7 31.6 30.4-0820           19.7
   (MIN)  1.6  1.9-2250   2.5-0000  4.5  0.0   0.0-0000   0.0-0000  1.7  8.1 10.8-0530           19.7
WED(MAX)  7.1  6.5-1130   4.5-0650  2.9  3.8   3.1-1120   1.2-0630  0.4 31.1 27.9-0810           17.4
   (MIN)  1.3  1.6-2230   2.1-1600  2.9  0.0   0.0-0000   0.0-0000  0.4  7.3  8.3-0530           17.4
THU(MAX)  5.4  3.6-1950   2.8-1600  2.4  1.0   0.2-1010   0.0-0310  0.0  5.2  5.0-0540            4.7
   (MIN)  1.4  1.8-0030   2.1-0000  2.4  0.0   0.0-0000   0.0-0000  0.0  4.0  4.4-0910            4.7
FRI(MAX)  5.2  4.7-1040   3.8-0920  2.7  2.9   2.3-1030   1.1-0810  0.4 11.9 10.0-0610            7.0
   (MIN)  1.1  1.7-1720   2.2-0130  2.7  0.0   0.0-0000   0.0-0000  0.4  4.3  5.0-0910            7.0
SAT(MAX) 10.4  9.6-1500   6.3-1100  3.8  7.0   6.3-1440   4.1-1020  1.3
   (MIN)  1.3  1.9-0000   2.4-0000  3.8  0.0   0.0-0000   0.0-0000  1.3
SUN(MAX)  8.5  8.1-1420   5.1-1010  3.2  6.1   5.6-1410   2.6-0950  1.0
   (MIN)  1.1  1.5-0850   2.1-0150  3.2  0.0   0.0-0000   0.1-0000  1.0

MON(MAX)  5.8  4.9-1210   3.8-0750  3.0  2.8   2.3-1200   1.0-0850  0.3 27.2 18.5-0810           14.5
   (MIN)  1.4  2.0-0440   2.4-0000  3.0  0.0   0.0-0000   0.0-0000  0.3  0.0  7.8-0520           14.5
TUE(MAX)  6.7  5.8-1330   3.7-1130  2.9  2.8   2.1-1400   0.4-1140  0.2 11.2 10.6-0820            8.7
   (MIN)  1.2  1.3-0620   2.3-0030  2.9  0.0   0.0-0000   0.0-0000  0.2  0.0  6.4-0930            8.7
WED(MAX) 15.1 14.6-1150   7.6-0830  4.2 11.7  11.0-1200   3.9-0820  1.3 36.1 14.0-0610           17.7
   (MIN)  1.9  2.0-1910   2.5-1600  4.2  0.0   0.0-0000   0.0-0000  1.3 11.0 12.4-0530           17.7
THU(MAX)  7.5  7.3-1220   5.6-0850  3.6  4.9   4.7-1220   2.6-1100  0.9 19.7 14.7-0520           12.6
   (MIN)  1.7  1.9-2200   2.4-0010  3.6  0.0   0.0-0000   0.0-0000  0.9  8.5 10.6-0620           12.6
FRI(MAX)  5.6  4.8-1420   3.4-0850  2.6  3.2   1.4-0830   0.3-0850  0.1 28.4 10.3-0830            9.3
   (MIN)  1.7  1.8-0340   2.0-0000  2.6  0.0   0.0-0000   0.0-0000  0.1  4.7  5.9-0600            9.3
SAT(MAX)  7.8  7.7-1240   5.2-0900  3.5  5.2   5.1-1240   2.7-0840  1.0
   (MIN)  2.0  2.2-0520   2.4-0050  3.5  0.0   0.0-0000   0.0-0000  1.0
SUN(MAX)  6.3  5.9-1120   4.1-1000  2.9  4.0   3.5-1120   1.8-0920  0.6
   (MIN)  1.3  1.6-2000   2.2-0040  2.9  0.0   0.0-0000   0.0-0000  0.6
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SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA

CPA70-611421113SR049
10/13/69-10/26/69

RUN DATE 02/10/70-005
COMMERCE

DAY	OX				O3				NO2M			
	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR
MON(MAX)	5.7	4.7-1320	3.5-0840	2.9	1.5	0.5-0710	0.1-0750	0.0	15.9	14.7-0840		10.0
(MIN)	2.3	2.4-0310	2.6-0030	2.9	0.0	0.0-0000	0.0-0000	0.0	4.7	6.8-0550		10.0
TUE(MAX)	4.8	4.7-1020	3.3-0910	2.3	1.4	1.3-1020	0.3-1020	0.1				
(MIN)	0.4	0.2-1910	0.5-1500	2.3	0.0	0.0-0000	0.0-0000	0.1				
WED(MAX)	9.4	8.4-1500	4.2-0940	2.4	5.8	4.6-1500	1.1-0840	0.3	15.9	12.1-0820		10.0
(MIN)	0.4	0.3-0340	0.5-0000	2.4	0.0	0.0-0000	0.0-0000	0.3	6.9	10.7-0840		10.0
THU(MAX)	5.5	5.3-1240	3.6-0720	2.7	0.0	0.0-0000	0.0-0000	0.0	17.4	8.3-0640		9.2
(MIN)	0.9	1.5-2120	1.9-1600	2.7	0.0	0.0-0000	0.0-0000	0.0	5.4	6.2-0550		9.2
FRI(MAX)	3.5	3.0-1150	2.5-0830	2.1	0.0	0.0-0000	0.0-0000	0.0				
(MIN)	1.0	1.5-0230	1.8-0000	2.1	0.0	0.0-0000	0.0-0000	0.0				
SAT(MAX)	4.1	3.9-1600	2.6-1550	2.1	2.0	1.8-1550	0.4-1340	0.1				
(MIN)	1.0	1.5-1110	1.8-0010	2.1	0.0	0.0-0000	0.0-0000	0.1				
SUN(MAX)	5.8	5.6-1210	3.9-1020	3.0	3.3	3.1-1210	1.5-0920	0.6				
(MIN)	1.5	2.0-0230	2.2-0150	3.0	0.0	0.0-0000	0.2-0350	0.6				
MON(MAX)	3.9	3.0-0910	2.6-1440	2.5	1.9	0.6-0840	0.1-0140	0.0	17.2	15.3-0710		10.7
(MIN)	1.6	2.0-0230	2.3-0110	2.5	0.0	0.0-0000	0.0-0940	0.0	3.3	5.2-0830		10.7
TUE(MAX)	8.3	5.1-0920	3.3-0920	2.8	5.4	2.3-0900	0.4-0530	0.1	13.9	12.4-0620		11.7
(MIN)	2.1	2.2-2220	2.5-1600	2.8	0.0	0.0-0000	0.0-0000	0.1	9.8	11.1-0740		11.7
WED(MAX)	5.7	5.3-1300	3.4-0930	2.7	3.1	2.7-1300	0.8-0630	0.3	7.9	7.3-0810		6.1
(MIN)	1.9	2.1-0720	2.2-0050	2.7	0.0	0.0-0000	0.0-0000	0.3	5.0	5.5-0550		6.1
THU(MAX)	5.5	4.9-1110	3.8-1040	2.9	2.4	1.8-1110	0.8-1050	0.3	20.5	18.9-1000		12.1
(MIN)	1.8	2.0-0710	2.2-0010	2.9	0.0	0.0-0000	0.0-0000	0.3	5.6	7.2-0610		12.1
FRI(MAX)	4.4	3.6-1150	2.8-0610	2.3	1.9	0.7-1150	0.1-0610	0.0	11.3	9.5-0910		8.3
(MIN)	1.4	1.7-1850	2.0-1550	2.3	0.0	0.0-0000	0.0-1250	0.0	5.8	6.9-0620		8.3
SAT(MAX)	7.7	6.5-1220	3.8-1010	2.7	5.1	4.6-1230	1.7-1100	0.5				
(MIN)	1.4	1.7-1950	2.0-0100	2.7	0.0	0.0-0000	0.0-0000	0.5				
SUN(MAX)	7.4	5.9-1300	4.4-1120	2.7	5.1	3.7-1300	2.0-0950	0.6				
(MIN)	1.5	1.7-0220	1.8-0000	2.7	0.0	0.0-0020	0.0-0000	0.6				

SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA

CPA70-611421113SR049
10/27/69-11/09/69

RUN DATE 02/10/70-006
COMMERCE

DAY	OX				O3				NO2M			
	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR
MON(MAX)	7.1	6.2-1240	3.7-0700	2.7	3.8	2.8-1240	0.6-0740	0.2	26.8	25.4-1130	17.8-0450	17.8
(MIN)	0.7	1.4-2300	2.0-0000	2.7	0.0	0.0-0020	0.0-0000	0.2	8.4	9.2-0620	17.8-0450	17.8
TUE(MAX)	12.0	6.8-1350	4.0-0700	2.8	4.4	2.4-1410	0.3-1010	0.2	28.3	21.0-0900		14.6
(MIN)	1.3	1.6-0220	2.5-1600	2.8	0.0	0.0-0010	0.0-1510	0.2	9.1	9.7-0630		14.6
WED(MAX)	13.6	12.7-1340	7.9-0820	4.4	10.8	9.8-1340	4.7-1100	1.6	51.7	41.9-0940		28.6
(MIN)	1.6	1.8-0020	2.0-0000	4.4	0.0	0.0-0000	0.0-0000	1.6	16.9	20.7-0720		28.6
THU(MAX)	9.7	9.0-1310	5.5-0900	3.8	6.2	5.6-1310	2.2-0650	0.8	11.0	10.1-0620		7.5
(MIN)	1.4	1.7-0430	2.2-0000	3.8	0.0	0.0-0000	0.0-1540	0.8	3.7	5.6-1020		7.5
FRI(MAX)	11.8	11.6-1220	5.7-0640	3.8	5.9	5.5-1220	1.3-0610	0.4	18.2	16.1-1000		10.8
(MIN)	2.2	2.3-0420	2.5-0050	3.8	0.0	0.0-0000	0.0-1300	0.4	7.7	8.5-0630		10.8
SAT(MAX)	15.5	14.2-1220	9.4-1100	5.2	11.8	10.5-1220	6.2-1100	1.9	16.6	13.4-0950		11.1
(MIN)	2.5	2.6-0900	2.8-0210	5.2	0.0	0.0-0000	0.0-0000	1.9	5.6	9.3-0720		11.1
SUN(MAX)	15.4	14.3-1340	8.5-1100	5.1	12.2	11.2-1340	5.6-1100	2.0	15.1	12.4-0650		10.2
(MIN)	2.7	3.0-2200	3.3-0140	5.1	0.0	0.0-0000	0.0-0000	2.0	3.2	6.5-1050		10.2
MON(MAX)	8.5	8.1-1140	4.5-0850	3.4	5.3	4.9-1140	1.1-1040	0.3	27.2	26.0-0940		18.5
(MIN)	2.4	2.5-0340	2.8-1600	3.4	0.0	0.0-0000	0.0-0000	0.3	9.6	12.1-0740		18.5
TUE(MAX)	8.9	8.9-1300	5.8-0850	3.7	5.9	5.8-1300	2.1-1100	0.6	36.9	34.0-0910		24.5
(MIN)	2.3	2.4-2110	2.7-0000	3.7	0.0	0.0-0000	0.1-0000	0.6	14.0	15.9-0640		24.5
WED(MAX)	2.7	2.6-1140	2.5-1030	2.4	0.0	0.0-0000	0.0-0000	0.0	10.2	9.0-0800		7.9
(MIN)	2.1	2.1-0250	2.3-0100	2.4	0.0	0.0-0000	0.0-0000	0.0	5.8	7.1-0900		7.9
THU(MAX)	2.8	2.5-0440	2.3-0000	2.3	0.0	0.0-0000	0.0-0000	0.0	5.2			3.7
(MIN)	1.9	2.1-2200	2.2-1600	2.3	0.0	0.0-0000	0.0-0000	0.0	0.0			3.7
FRI(MAX)	2.8	2.6-1210	2.3-1150	2.2	0.0	0.0-0000	0.0-0000	0.0	6.8	5.0-0720		4.6
(MIN)	1.8	1.9-0820	2.0-0330	2.2	0.0	0.0-0000	0.0-0000	0.0	2.9	4.3-0830		4.6
SAT(MAX)	3.5	2.8-1620	2.4-0930	2.2	1.2	0.3-1620	0.0-1350	0.0				
(MIN)	1.8	1.9-0320	2.0-0010	2.2	0.0	0.0-0000	0.0-0000	0.0				
SUN(MAX)	2.6	2.6-1430	2.3-0820	2.2	0.0	0.0-0030	0.0-0000	0.0				
(MIN)	1.8	1.9-1640	2.1-1600	2.2	0.0	0.0-0030	0.0-0000	0.0				

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SCOTT RESEARCH LABORATORIES                 CPA70-611421113SR049                 RUN DATE 02/10/70-007
SUMMARY GROUND DATA                          11/10/69-11/14/69                               COMMERCE

DAY                     OX                                    O3                                     NO2M
           H/L  1HR-TIME   8HR-TIME  24HR  H/L  1HR-TIME   8HR-TIME  24HR  H/L  1HR-TIME   8HR-TIME  24HR

MON(MAX)   3.1  2.8-1420   2.5-1030   2.3  0.0  0.0-0100   0.0-0000   0.0 13.4  9.5-0700              6.8
   (MIN)   1.7  1.9-2200   2.2-0000   2.3  0.0  0.0-0100   0.0-0000   0.0  3.5  4.9-0920              6.8
TUE(MAX)   2.8  2.7-1540   2.6-1340   2.3  1.7  0.6-0700   0.2-0200   0.1  6.4  5.1-0640              4.5
   (MIN)   1.0  1.4-0510   1.9-0000   2.3  0.0  0.0-0010   0.0-1000   0.1  2.8  4.0-0730              4.5
WED(MAX)   2.9  2.7-1240   2.5-0830   2.5  0.0  0.0-0000   0.0-0000   0.0  9.9  8.6-0740              7.6
   (MIN)   2.2  2.3-0510   2.4-0040   2.5  0.0  0.0-0000   0.0-0000   0.0  4.0  6.9-0910              7.6
THU(MAX)   7.9  6.8-1140   4.3-0910   3.2  4.4  3.4-1140   1.0-0540   0.3 14.1  9.2-0900              8.4
   (MIN)   2.2  2.3-0440   2.4-0000   3.2  0.0  0.0-0000   0.0-0000   0.3  4.9  5.7-0650              8.4
FRI(MAX)   3.4  3.3-0840   2.8-0320   2.7  0.0  0.0-0000   0.0-0000   0.0 14.3 12.8-0830             11.3
   (MIN)   2.4  2.5-0020   2.7-0000   2.7  0.0  0.0-0000   0.0-0000   0.0  9.0 10.5-0630             11.3
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SCOTT RESEARCH LABORATORIES                    CPA70-611421113SR049                   RUN DATE 02/10/70-001
SUMMARY GROUND DATA                             08/18/69-08/31/69                                  EL MONTE

DAY                        OX                                        O3                                    NO2M
          H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX) 17.0 16.5-1140   9.8-0920  5.2 15.0 14.5-1140   8.4-0920  4.1 14.4 11.6-0800            10.5
   (MIN)  0.5  0.5-2150   1.8-1600  5.2  0.0  0.0-0640   1.0-1600  4.1  7.4  8.5-1200            10.5
TUE(MAX) 23.0 22.2-1220  14.6-1020  5.6 21.0 20.2-1220  12.9-1020  4.4
   (MIN)  0.5  0.5-0000   0.6-0000  5.6  0.0  0.0-0000   0.0-0000  4.4
WED(MAX) 38.0 33.2-1200  17.4-0920  6.5 35.0 30.2-1200  15.3-0930  5.4
   (MIN)  0.5  0.5-0000   0.6-0000  6.5  0.0  0.0-0000   0.0-0000  5.4
THU(MAX) 36.0 33.2-1130  16.2-0850  6.2 32.0 29.3-1130  13.9-0850  4.8
   (MIN)  0.5  0.5-0000   0.6-0000  6.2  0.0  0.0-0000   0.0-0000  4.8
FRI(MAX) 42.0 37.3-1110  15.0-0820  5.9 37.0 32.3-1110  12.5-0830  4.4
   (MIN)  0.5  0.5-2140   1.2-0000  5.9  0.0  0.0-0000   0.0-0000  4.4
SAT(MAX) 21.0 20.3-1220  14.9-0930  5.6 19.0 18.3-1220  12.9-0930  4.4
   (MIN)  0.5  0.5-0000   0.6-0000  5.6  0.0  0.0-0000   0.0-0000  4.4
SUN(MAX) 19.0 17.3-1520   9.5-0950  3.7 18.0 16.3-1520   8.5-0950  3.0
   (MIN)  0.5  0.5-0000   0.6-0000  3.7  0.0  0.0-0000   0.0-0000  3.0

MON(MAX) 15.0 14.7-1200   9.4-0930  3.7 14.0 13.5-1200   8.3-0930  2.9 12.6 11.1-0720             8.9
   (MIN)  0.5  0.5-0000   0.5-0000  3.7  0.0  0.0-0000   0.0-0000  2.9  4.8 11.1-0720             8.9
TUE(MAX) 19.0 15.7-1220  10.6-1030  4.2 18.0 14.7-1220   9.6-1030  3.4 15.3 12.3-0910  7.6-0730  7.6
   (MIN)  0.5  0.5-0000   0.5-0000  4.2  0.0  0.0-0000   0.0-0000  3.4  0.0  4.4-1230  7.6-0730  7.6
WED(MAX) 22.0 21.2-1210  14.5-1010  5.8 20.0 19.2-1210  13.2-1010  4.8  8.5  8.0-0830             6.9
   (MIN)  0.5  0.5-0510   0.9-0000  5.8  0.0  0.0-0000   0.3-0000  4.8  4.0  5.5-0950             6.9
THU(MAX) 14.0 13.8-1220  11.0-1020  4.5 13.0 12.8-1220  10.0-1020  3.6 14.0  9.0-1000             6.7
   (MIN)  0.5  0.5-0000   0.6-0000  4.5  0.0  0.0-0000   0.0-0000  3.6  2.5  3.1-1310             6.7
FRI(MAX) 11.0 10.0-1430   7.4-0910  3.3 10.0  9.0-1430   6.4-0910  2.3 10.2  6.3-0750             5.9
   (MIN)  1.0  1.0-0000   1.3-0000  3.3  0.0  0.0-0000   0.3-0000  2.3  3.0  6.1-0710             5.9
SAT(MAX) 19.0 18.3-1200  12.4-0940  5.1 17.0 16.3-1200  11.1-0940  4.0
   (MIN)  1.0  1.0-0000   1.0-0000  5.1  0.0  0.0-0000   0.0-0000  4.0
SUN(MAX) 20.0 18.5-1210  12.1-0900  4.8 18.0 16.5-1210  10.6-0900  3.7
   (MIN)  0.5  0.5-0440   0.9-0000  4.8  0.0  0.0-0000   0.0-0000  3.7
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SCOTT RESEARCH LABORATORIES           CPA70-611421113SR049              RUN DATE 02/10/70-002
SUMMARY GROUND DATA                    09/01/69-09/14/69                            EL MONTE

DAY                        OX                                  O3                                   NO2M
           H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX)  20.0 18.5-1200 12.5-0930  4.9 18.0 16.7-1220 11.4-0930  4.0
   (MIN)   0.5  0.5-0000  0.6-0000  4.9  0.0  0.0-0000  0.0-0000  4.0
TUE(MAX)  24.0 21.8-1130 11.9-0930  4.4 22.0 19.8-1130 10.4-0940  3.5 26.5 22.1-0920 16.2-0550 14.0
   (MIN)   0.4  0.5-2300  0.6-0000  4.4  0.0  0.0-0000  0.0-0000  3.5  5.9  6.7-1410 12.2-0940 14.0
WED(MAX)  22.0 21.0-1110 13.7-0950  5.4 19.7 18.6-1120 11.1-0940  4.0 21.1 17.8-0940 13.2-0440 11.3
   (MIN)   0.3  0.3-0320  0.5-0000  5.4  0.0  0.0-0000  0.0-0000  4.0  2.3  5.5-1330 10.4-0910 11.3
THU(MAX)  19.8 19.5-1110 12.0-0910  4.8 18.1 17.6-1110 10.5-0900  3.8 21.0 16.1-1020 13.0-0440 11.1
   (MIN)   0.2  0.2-0300  0.4-0000  4.8  0.0  0.0-0000  0.0-0000  3.8  4.9  5.7-1410 10.0-0930 11.1
FRI(MAX)  15.2 14.8-1130  8.4-0940  3.2 14.1 13.7-1130  7.2-0920  2.6 22.2 20.4-0840 14.7-0440 12.4
   (MIN)   0.1  0.1-2230  0.3-0000  3.2  0.0  0.0-0000  0.0-0000  2.6  0.0  5.7-1410 11.3-0940 12.4
SAT(MAX)  16.1 14.6-1230  7.2-0900  2.5 14.3 13.1-1230  5.3-0900  1.6
   (MIN)   0.0  0.0-0320  0.2-0000  2.5  0.0  0.0-0000  0.0-0000  1.6
SUN(MAX)  10.7 10.1-1140  6.7-0920  2.6  9.6  9.0-1140  5.7-0840  2.0
   (MIN)   0.1  0.1-0330  0.3-0000  2.6  0.0  0.0-0000  0.0-0000  2.0

MON(MAX)  16.5 15.8-1140  8.9-0640  3.6 14.9 14.2-1140  7.6-0640  2.6 39.8 33.1-0940 17.8-0520 14.7
   (MIN)   0.0  0.0-0250  0.1-0000  3.6  0.0  0.0-0000  0.0-0000  2.6  5.9  7.0-1450 12.6-0950 14.7
TUE(MAX)  24.2 21.9-1150 13.1-0930  4.9 21.9 19.7-1150 11.3-0930  3.7 35.5 29.0-1020 20.5-0510 18.9
   (MIN)   0.3  0.3-0320  0.4-0000  4.9  0.0  0.0-0000  0.0-0000  3.7  7.3 11.0-1250 19.0-0710 18.9
WED(MAX)  27.5 27.3-1200 17.0-0940  6.5 25.2 24.8-1210 15.0-0940  5.1 41.5 36.9-0930 25.0-0540 23.3
   (MIN)   0.6  0.7-2300  1.0-0000  6.5  0.0  0.0-0000  0.0-0000  5.1  6.5  8.4-1150 23.3-0710 23.3
THU(MAX)  19.2 18.3-1410 13.7-1000  5.4 17.2 16.3-1410 10.9-0950  3.8 26.0 21.9-0850           17.0
   (MIN)   0.5  0.6-0140  0.7-0000  5.4  0.0  0.0-0000  0.0-0000  3.8 10.1 14.7-0720           17.0
FRI(MAX)  16.2 15.3-1050  9.8-0800  3.7 13.7 12.9-1050  8.3-0740  2.6 21.2 16.3-0920 11.9-0700 11.6
   (MIN)   0.5  0.5-2300  1.0-0000  3.7  0.0  0.0-0000  0.0-0000  2.6  5.6  6.2-1430 11.4-0740 11.6
SAT(MAX)  11.4 10.8-1130  6.2-0930  2.7  9.9  9.4-1130  4.9-0940  1.6
   (MIN)   0.3  0.3-0430  0.5-0000  2.7  0.0  0.0-0000  0.0-0000  1.6
SUN(MAX)   7.8  7.4-1130  5.4-0930  2.2  5.7  5.4-1130  3.8-0930  1.2
   (MIN)   0.4  0.5-2300  0.8-0100  2.2  0.0  0.0-0000  0.1-0000  1.2
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SCOTT RESEARCH LABORATORIES                  CPA70-611421113SR049                RUN DATE 02/10/70-003
SUMMARY GROUND DATA                           09/15/69-09/28/69                              EL MONTE

DAY                         OX                                 O3                             NO2M
           H/L  1HR-TIME  8HR-TIME  24HR  H/L  1HR-TIME  8HR-TIME  24HR  H/L  1HR-TIME  8HR-TIME  24HR

MON(MAX)   8.2   8.0-1300  4.6-1100  2.0   5.4  4.8-1320  2.7-1100  0.9 67.6 21.5-1220            8.0
   (MIN)   0.3   0.3-0320  0.5-0000  2.0   0.0  0.0-0000  0.0-0000  0.9  3.0  3.3-0710            8.0
TUE(MAX)  12.4  10.6-1310  6.0-1000  2.6   9.3  8.7-1320  4.0-1010  1.3 10.5  9.1-1110            6.3
   (MIN)   0.4   0.4-0330  0.7-0000  2.6   0.0  0.0-0000  0.0-0000  1.3  1.9  3.4-0720            6.3
WED(MAX)  17.0  13.7-1320  7.7-0950  3.6  13.8 10.5-1320  5.5-1000  1.8 11.7 10.0-1340            8.4
   (MIN)   0.4   0.4-0220  1.2-0000  3.6   0.0  0.0-0000  0.0-0000  1.8  5.9  6.9-0720            8.4
THU(MAX)  15.6  15.3-1300  7.9-0840  3.2  14.0 13.6-1300  5.8-0910  2.0 14.7 12.8-1010           11.2
   (MIN)   0.4   0.5-0130  0.7-0000  3.2   0.0  0.0-0000  0.0-0000  2.0  7.5  9.5-1150           11.2
FRI(MAX)  16.0  14.7-1340  9.4-1040  3.7  14.0 12.7-1340  7.9-1040  2.7 13.0 11.6-1150            9.7
   (MIN)   0.4   0.5-0700  0.5-0000  3.7   0.0  0.0-0000  0.0-0000  2.7  6.8  7.7-1320            9.7
SAT(MAX)   7.0   5.8-1210  3.9-1030  2.3   6.0  4.8-1210  2.9-1010  1.2
   (MIN)   1.0   1.0-0000  1.6-0000  2.3   0.0  0.0-0000  0.6-0000  1.2
SUN(MAX)   8.0   7.8-1430  5.1-1010  2.4   7.0  6.8-1430  4.1-1020  1.4
   (MIN)   1.0   1.0-0000  1.0-0000  2.4   0.0  0.0-0000  0.0-0000  1.4


MON(MAX)  13.0  11.8-1200  8.5-1010  4.0  11.0 10.0-1220  7.2-1010  2.9 12.0  7.7-0730            6.4
   (MIN)   1.0   1.0-0000  1.0-0000  4.0   0.0  0.0-0000  0.0-0000  2.9  3.7  3.9-0940            6.4
TUE(MAX)  13.9  13.6-1220  8.7-0720  4.9  12.4 12.1-1220  7.2-0930  3.6 25.0 21.4-0830           11.4
   (MIN)   0.6   0.7-2300  1.4-1600  4.9   0.0  0.0-0750  0.5-1600  3.6  0.0  5.3-1220           11.4
WED(MAX)  20.7  18.8-1210  9.4-0910  3.8  18.9 17.1-1210  7.9-0910  2.7 20.1 19.4-1010           13.0
   (MIN)   0.5   0.6-0040  0.8-0000  3.8   0.0  0.0-0000  0.0-0000  2.7  8.1  8.3-1620           13.0
THU(MAX)  21.9  19.7-1210 10.2-0930  4.2  20.0 17.9-1210  8.8-0930  3.1 17.2 16.3-0920           13.5
   (MIN)   0.5   0.7-2110  0.8-0000  4.2   0.0  0.0-0000  0.0-0000  3.1  4.9 10.5-1440           13.5
FRI(MAX)  13.5  11.7-1250  6.0-1010  2.5  12.2 10.4-1250  5.0-0910  1.7 19.9 19.1-1040           15.7
   (MIN)   0.3   0.4-2140  0.8-0000  2.5   0.0  0.0-0000  0.0-0000  1.7  0.0 10.2-0750           15.7
SAT(MAX)  27.2  26.2-1310 14.8-0900  5.9  24.5 23.5-1310 13.1-0900  4.8 16.2 14.8-0740           12.0
   (MIN)   0.1   0.2-2110  0.6-0000  5.9   0.0  0.0-0000  0.0-0000  4.8  5.8  6.7-1350           12.0
SUN(MAX)  26.5  25.6-1250 16.8-0900  6.6  24.3 23.6-1310 15.3-0900  5.6 19.0 18.0-0850           11.2
   (MIN)   0.0   0.1-0040  0.2-0000  6.6   0.0  0.0-0000  0.0-0000  5.6  6.1  6.5-1140           11.2
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SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA

CPA70-611421113SR049
09/29/69-10/12/69

RUN DATE 02/10/70-004
EL MONTE

DAY	OX				O3				NO2M			
	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR
MON(MAX)	31.7	29.0-1140	13.9-0900	5.6	27.7	25.0-1140	11.8-0840	4.2	24.8	23.9-0840		15.2
(MIN)	0.1	0.2-0240	0.5-0000	5.6	0.0	0.0-0000	0.0-0000	4.2	7.4	7.9-1250		15.2
TUE(MAX)	22.0	18.8-1240	10.6-0930	4.1	20.8	17.6-1240	9.1-0930	3.2	35.8	32.6-0800		17.5
(MIN)	0.1	0.1-0100	0.4-0000	4.1	0.0	0.0-0000	0.0-0000	3.2	6.2	16.6-1010		17.5
WED(MAX)	11.1	10.5-1130	6.2-0940	2.5	10.0	9.5-1130	5.1-0950	1.6	25.5			14.3
(MIN)	0.1	0.2-0120	0.4-0000	2.5	0.0	0.0-0000	0.0-0000	1.6	3.8			14.3
THU(MAX)	3.0	3.0-1320	1.9-1600	1.4	2.0	2.0-1320	0.9-1600	0.6	6.1			5.2
(MIN)	0.1	0.1-0120	1.5-1110	1.4	0.0	0.0-0000	0.5-1110	0.6	4.4			5.2
FRI(MAX)	8.0	7.5-1140	5.6-1020	2.8	7.0	6.5-1140	4.6-1020	1.8	12.0			6.2
(MIN)	1.0	1.0-0220	1.2-0130	2.9	0.0	0.0-0220	0.2-0130	1.8	3.4			6.2
SAT(MAX)	6.0	4.8-1630	3.4-1000	1.8	5.0	3.8-1630	2.4-1000	0.8				
(MIN)	1.0	1.0-0000	1.0-0000	1.8	0.0	0.0-0000	0.0-0000	0.8				
SUN(MAX)	8.0	8.0-1450	4.8-0920	2.3	7.0	7.0-1450	4.0-0920	1.4				
(MIN)	1.0	1.0-0000	1.0-0000	2.3	0.0	0.0-0000	0.0-0000	1.4				
MON(MAX)	8.2	5.7-1450	2.1-1230	1.5	6.1	4.6-1450	1.0-1240	0.6	15.9	14.4-0750		9.4
(MIN)	0.3	0.4-2300	1.0-1600	1.5	0.0	0.0-1720	0.2-1600	0.6	2.3	13.5-0800		9.4
TUE(MAX)	10.2	9.2-1340	5.9-0900	2.3	9.1	8.0-1340	4.9-0900	1.6	19.1	17.8-0750		10.4
(MIN)	0.1	0.1-0320	0.7-0020	2.3	0.0	0.0-0000	0.1-0000	1.6	2.5	9.3-0920		10.4
WED(MAX)	24.0	21.8-1240	12.3-0930	4.3	21.0	19.3-1300	11.7-0940	3.9	21.6	18.5-0830		14.7
(MIN)	0.2	0.3-0440	0.4-0000	4.3	0.0	0.0-0000	0.0-0000	3.9	8.3	16.4-0740		14.7
THU(MAX)	13.0	12.8-1120	10.0-0930	4.0	12.0	11.8-1120	9.0-0930	3.1	23.2	22.1-0740		13.7
(MIN)	0.0	0.0-1950	1.0-0000	4.0	0.0	0.0-0000	0.0-0000	3.1	6.8	11.8-0940		13.7
FRI(MAX)	7.0	7.0-1120	4.3-0850	2.1	6.0	6.0-1120	3.3-0850	1.1	10.8	9.2-0750		7.8
(MIN)	1.0	1.0-0000	1.0-0000	2.1	0.0	0.0-0000	0.0-0000	1.1	5.1	8.8-0800		7.8
SAT(MAX)	8.0	7.8-1350	5.2-0910	2.4	7.0	6.8-1350	4.2-0910	1.4				
(MIN)	1.0	1.0-0000	1.0-0000	2.4	0.0	0.0-0000	0.0-0000	1.4				
SUN(MAX)	6.0	5.2-1150	3.1-0930	1.7	5.0	4.2-1150	2.1-0930	0.7				
(MIN)	1.0	1.0-0000	1.0-0000	1.7	0.0	0.0-0000	0.0-0000	0.7				

SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA

CPA70-611421113SR049
10/13/69-10/26/69

RUN DATE 02/10/70-005
EL MONTE

DAY	OX				O3				NO2M			
	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR	H/L	1HR-TIME	8HR-TIME	24HR
MON(MAX)	7.0	6.3-1320	3.7-0910	1.9	6.0	5.3-1320	2.7-0910	0.9	15.0	12.8-1000		9.6
(MIN)	1.0	1.0-0000	1.0-0000	1.9	0.0	0.0-0000	0.0-0000	0.9	4.3	10.7-0920		9.6
TUE(MAX)	5.0	4.8-1130	3.2-0900	1.7	4.0	4.0-1140	2.4-0910	0.8	15.1	14.5-0820		10.3
(MIN)	0.0	0.0-1710	1.0-0000	1.7	0.0	0.0-0000	0.0-0000	0.8	3.7	14.1-0850		10.3
WED(MAX)	7.0	6.3-1310	4.6-1000	2.0	6.0	5.3-1310	3.7-1000	1.2	13.0			8.0
(MIN)	0.0	0.0-1900	1.0-0000	2.0	0.0	0.0-0000	0.0-0000	1.2	6.2			8.0
THU(MAX)	11.0	9.5-1200	3.8-0730	1.3	10.0	8.5-1200	3.4-0730	1.1	10.7	9.4-0830		7.7
(MIN)	0.0	0.0-0000	0.0-0000	1.3	0.0	0.0-0000	0.0-0000	1.1	5.3	8.0-0910		7.7
FRI(MAX)	3.0	2.3-1040	1.4-0850	0.5	3.0	2.3-1040	1.4-0850	0.5	10.5	7.5-0810		6.1
(MIN)	0.0	0.0-0000	0.0-0000	0.5	0.0	0.0-0000	0.0-0000	0.5	3.8	5.8-0740		6.1
SAT(MAX)	3.0	3.0-1130	2.0-0930	0.7	3.0	3.0-1130	2.0-0930	0.7				
(MIN)	0.0	0.0-0000	0.0-0000	0.7	0.0	0.0-0000	0.0-0000	0.7				
SUN(MAX)	6.0	5.0-1240	2.4-0830	0.8	6.0	4.8-1250	2.2-0830	0.7				
(MIN)	0.0	0.0-0000	0.0-0000	0.8	0.0	0.0-0000	0.0-0000	0.7				
MON(MAX)	2.0	2.0-1450	1.3-0920	0.5	2.0	2.0-1450	1.3-0920	0.5	10.7	7.9-0720		3.5
(MIN)	0.0	0.0-0040	0.1-0040	0.5	0.0	0.0-0000	0.0-0000	0.5	1.1	3.3-0810		3.5
TUE(MAX)	3.0	2.5-1240	1.1-0550	0.4	3.0	2.5-1240	1.0-0550	0.4	15.7	12.3-0820		8.4
(MIN)	0.0	0.0-0000	0.0-0000	0.4	0.0	0.0-0000	0.0-0000	0.4	6.0	6.7-0910		8.4
WED(MAX)	9.0	8.2-1320	4.1-0920	1.4	7.0	7.0-1320	3.6-0830	1.2	11.8	8.7-0810		6.2
(MIN)	0.0	0.0-0000	0.0-0000	1.4	0.0	0.0-0000	0.0-0000	1.2	3.6	4.8-0900		6.2
THU(MAX)	11.0	10.2-1240	6.0-0920	2.4	9.0	8.2-1240	4.7-0920	1.6	10.5	9.6-0820		9.2
(MIN)	0.0	0.0-0000	0.1-0000	2.4	0.0	0.0-0000	0.0-0000	1.6	7.5	8.0-0940		9.2
FRI(MAX)	6.0	5.5-1210	2.9-0900	1.6	5.0	4.5-1210	2.0-0820	0.7	9.7	6.6-0820		5.9
(MIN)	0.0	0.0-0510	0.6-0100	1.6	0.0	0.0-0000	0.0-0000	0.7	0.2	6.2-0840		5.9
SAT(MAX)	11.0	10.2-1410	5.7-0910	2.5	9.0	8.2-1410	4.2-0910	1.4				
(MIN)	0.0	0.0-0500	0.9-1600	2.5	0.0	0.0-0050	0.0-0000	1.4				
SUN(MAX)	11.0	10.8-1340	5.7-0930	2.1	9.0	8.8-1340	4.2-0930	1.4				
(MIN)	0.0	0.0-0000	0.3-0000	2.1	0.0	0.0-0000	0.0-0000	1.4				

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SCOTT RESEARCH LABORATORIES              CPA70-611421113SR049               RUN DATE 02/10/70-006
SUMMARY GROUND DATA                       10/27/69-11/07/69                             EL MONTE


DAY                       OX                                 O3                                NO2M
           H/L  1HR-TIME   8HR-TIME  24HR  H/L  1HR-TIME   8HR-TIME  24HR  H/L  1HR-TIME   8HR-TIME  24HR

MON(MAX) 12.0 11.0-1310  4.6-0910  1.8 10.0  9.0-1310  3.2-0830  1.1 17.9 17.1-1020              15.0
   (MIN)  0.0  0.0-0000  0.0-0000  1.8  0.0  0.0-0000  0.0-0000  1.1 11.0 12.1-0850              15.0
TUE(MAX) 12.0 10.8-1450  4.7-1000  1.6 10.0  9.2-1450  3.5-0900  1.2 21.3 17.6-1010              14.9
   (MIN)  0.0  0.0-0000  0.0-0000  1.6  0.0  0.0-0000  0.0-0000  1.2  9.1 10.0-1400              14.9
WED(MAX) 22.0 20.3-1340 11.6-0950  4.1 19.0 17.7-1350  9.7-0930  3.3 18.4 16.0-0910              10.4
   (MIN)  0.0  0.0-0000  0.0-0000  4.1  0.0  0.0-0000  0.0-0000  3.3  3.8  7.9-1030              10.4
THU(MAX) 12.0 10.2-1430  5.7-1000  1.9 10.0  8.2-1430  4.5-1000  1.5 15.7 15.3-1910               7.8
   (MIN)  0.0  0.0-0000  0.0-0000  1.9  0.0  0.0-0000  0.0-0000  1.5  2.2  3.2-1200               7.8
FRI(MAX) 12.0 10.7-1350  4.9-0910  1.6 12.0 10.0-1350  4.4-0910  1.5 13.4 11.3-1710               9.1
   (MIN)  0.0  0.0-0000  0.0-0000  1.6  0.0  0.0-0000  0.0-0000  1.5  4.3  7.6-0900               9.1
SAT(MAX) 20.0 15.0-1320  7.3-0940  2.5 19.0 14.0-1320  6.8-0940  2.3 11.5 10.7-0850               8.2
   (MIN)  0.0  0.0-0000  0.0-0000  2.5  0.0  0.0-0000  0.0-0000  2.3  6.3 10.6-0910               8.2
SUN(MAX)  9.0  7.7-1350  4.4-0900  1.5  9.0  7.7-1350  4.2-0920  1.5  9.5  7.9-0850               5.0
   (MIN)  0.0  0.0-0000  0.0-0000  1.5  0.0  0.0-0000  0.0-0000  1.5  2.6  7.9-0850               5.0


MON(MAX) 16.0 14.3-1300  6.6-0850  2.3 14.0 12.8-1300  5.5-0850  1.9 22.2 17.0-0930              12.2
   (MIN)  0.0  0.0-0000  0.1-0000  2.3  0.0  0.0-0000  0.1-0000  1.9  6.6 10.5-1010              12.2
TUE(MAX) 14.0 12.5-1220  8.0-0940  2.9 12.0 10.7-1240  6.5-0940  2.2 42.7 35.2-1100 19.9-0740 19.6
   (MIN)  0.0  0.0-0000  0.3-0000  2.9  0.0  0.0-0000  0.1-0000  2.2  7.4  8.3-1350 19.5-0900 19.6
WED(MAX)  2.0  2.0-0930  1.3-0420  0.6  2.0  2.0-0930  1.3-0420  0.6  7.8  6.9-0850               5.2
   (MIN)  0.0  0.0-0000  0.0-1600  0.6  0.0  0.0-0000  0.0-1600  0.6  3.7  6.0-0940               5.2
THU(MAX)  1.0  1.0-0430  0.3-0000  0.1  1.0  1.0-0430  0.3-0000  0.1  4.5                         3.4
   (MIN)  0.0  0.0-0000  0.0-0630  0.1  0.0  0.0-0000  0.0-0630  0.1  2.4                         3.4
FRI(MAX)  1.0  1.0-0920  0.5-0640  0.2  1.0  0.8-1120  0.2-0640  0.1  4.0                         2.9
   (MIN)  0.0  0.0-0000  0.0-0000  0.2  0.0  0.0-0000  0.0-0000  0.1  2.1                         2.9
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SCOTT RESEARCH LABORATORIES            CPA70-611421113SR049               RUN DATE 02/10/70-001
SUMMARY GROUND DATA                     08/18/69-08/31/69                           COMMERCE

DAY                    CO                               HC                                NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)  5.4  4.9-0940  4.1-0430  2.8  4.1  3.2-0650  2.3-0430  1.4 41.9 27.7-0740            14.8
   (MIN)  1.1  1.3-2120  1.5-1600  2.8  0.5  0.6-1800  0.7-1600  1.4  4.4  8.4-1430            14.8
TUE(MAX)  6.1  5.9-0620  3.1-0140  2.7  2.9  2.7-0540  1.9-0140  1.7 38.3 29.4-0700            16.4
   (MIN)  1.2  1.4-0010  2.7-0000  2.7  1.0  1.1-0000  1.7-0000  1.7  4.4  8.2-1500            16.4
WED(MAX)  6.8  5.9-2210  4.8-1520  4.7  2.9  2.5-2220  1.8-1600  1.8 44.8 24.4-1220            26.8
   (MIN)  3.6  4.0-2040  4.7-1600  4.7  1.1  1.4-1750  1.7-1510  1.8 15.0 19.7-1310            26.8
THU(MAX) 18.4 16.4-0910 12.0-0340  7.5  8.9  8.0-0910  5.9-0250  3.8 65.5 60.2-0700            32.9
   (MIN)  1.0  1.8-1830  4.0-1600  7.5  1.5  1.8-1520  2.2-1140  3.8 14.2 18.0-1350            32.9
FRI(MAX) 29.7 24.6-0640 14.1-0310  8.0 18.7 15.8-0630  9.9-0200  5.8107.4 92.8-0650 41.7-0630 36.1
   (MIN)  2.7  3.2-1320  3.9-1210  8.0  1.9  2.3-1720  2.7-1220  5.8  9.4 11.5-1510 26.8-0830 36.1
SAT(MAX)  9.5  8.9-0120  6.7-0710  6.6  7.6  7.4-0050  5.7-0020  5.0
   (MIN)  4.8  5.2-0440  6.5-0240  6.6  2.1  2.7-2250  4.3-0700  5.0
SUN(MAX)  9.4  8.7-0220  7.5-0130  4.4  6.1  5.2-0550  4.2-0000  2.8
   (MIN)  0.0  0.1-1800  0.4-1330  4.4  1.2  1.5-1820  1.6-1510  2.8

MON(MAX)  5.6  4.6-1540  3.6-1450  2.9  5.5  4.9-0320  2.9-1520  3.3 64.9 47.0-0610 30.1-0340 29.9
   (MIN)  0.9  1.6-0000  3.4-1600  2.9  2.2  2.4-1740  2.8-1320  3.3 11.0 13.5-0930 27.0-0640 29.9
TUE(MAX)  7.8  5.3-0640  4.0-0510  3.0  4.4  3.6-1130  3.0-1100  2.6 21.3 16.3-1210            13.0
   (MIN)  0.7  0.9-0340  2.1-0000  3.0  1.7  1.9-0330  2.3-0000  2.6  4.6  9.0-0810            13.0
WED(MAX)  9.7  6.9-0550            5.5  2.5  1.8-0550            1.7 52.0 35.5-0510            21.2
   (MIN)  2.6  3.7-0450            5.5  0.8  1.7-0530            1.7 12.5 14.6-0750            21.2
THU(MAX)  4.2  3.9-1430            3.2  1.4  1.4-2110            1.4 28.3 23.2-0610            17.9
   (MIN)  1.9  2.7-2020            3.2  1.3  1.3-2250            1.4 13.5 14.2-0720            17.9
FRI(MAX)  6.0  4.3-0740  3.3-0500  3.0  1.4  1.4-0310  1.4-0030  1.4 21.0 15.7-0720            12.7
   (MIN)  1.6  1.8-0100  2.6-0000  3.0  1.3  1.3-0120  1.4-0010  1.4  7.3  9.7-0900            12.7
SAT(MAX)  6.0  5.5-2200  4.9-1600  4.3
   (MIN)  2.0  2.4-0000  3.4-0000  4.3
SUN(MAX)
   (MIN)
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SCOTT RESEARCH LABORATORIES              CPA70-611421113SR049                 RUN DATE 02/10/70-002
SUMMARY GROUND DATA                       09/01/69-09/14/69                              COMMERCE


DAY                        CO                                   HC                                NOXM
           H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)   3.5  2.6-2300  1.1-1600  1.1
   (MIN)   0.0  0.0-1530  0.6-1310  1.1
TUE(MAX)  16.0 13.4-0650  8.5-0340  5.7  2.3  2.2-1310            1.7 59.6 51.3-0640           36.1
   (MIN)   0.9  2.2-1530  4.2-0920  5.7  1.0  1.5-1530            1.7 12.2 18.4-0900           36.1
WED(MAX)   3.2  2.7-1500  2.1-1200  1.9  2.2  1.9-2100  1.4-1400  1.4 43.9 38.0-0540           27.4
   (MIN)   1.1  1.3-1810  1.7-1600  1.9  0.9  1.0-1810  1.3-1600  1.4 14.8 19.0-0750           27.4
THU(MAX)  12.2 11.8-0830  7.9-0420  4.3  6.4  6.0-0840  3.3-0630  2.5 69.0 61.7-0530           38.9
   (MIN)   1.3  1.6-0000  2.2-1600  4.3  1.3  1.4-2030  1.6-1530  2.5 11.7 27.3-0740           38.9
FRI(MAX)  11.5  9.9-0650  6.2-0440  3.8  5.3  5.1-0730  3.5-0430  2.2 45.3 39.3-0710           32.2
   (MIN)   1.4  1.8-2110  2.2-1600  3.8  0.7  1.0-1610  1.3-1500  2.2 21.6 26.0-0830           32.2
SAT(MAX)  10.2  9.4-0900  7.5-0350  4.5  8.2  6.5-0800  5.3-0220  3.1
   (MIN)   0.8  1.2-1540  1.8-1430  4.5  0.6  0.7-1550  1.0-1400  3.1
SUN(MAX)   3.8  3.6-0750  3.1-0530  2.8  2.5  2.4-0750  1.4-0530  1.1
   (MIN)   1.9  2.2-1540  2.6-1410  2.8  0.6  0.6-1430  0.9-1030  1.1


MON(MAX)   6.4  6.0-0850  4.3-0630  3.8  4.7  4.0-0320  2.5-0630  2.5 34.3 31.8-0720           23.7
   (MIN)   2.4  2.7-2100  3.1-1540  3.8  1.4  1.6-1510  1.9-1230  2.5 11.2 16.1-0950           23.7
TUE(MAX)  11.0  9.7-0830  7.2-0450  4.8  8.4  7.8-0750  6.4-0350  3.8 42.7 38.3-0640           31.0
   (MIN)   2.8  3.1-1240  3.5-1600  4.8  1.3  1.5-1630  1.9-1310  3.8  0.0 18.5-0910           31.0
WED(MAX)  21.0 18.8-0810 12.3-0340  6.5  8.4  7.8-0750  6.5-0350  3.9 88.7 78.8-0640           60.0
   (MIN)   1.5  1.9-2020  2.7-1600  6.5  1.3  1.5-1630  1.9-1310  3.9 23.9 60.3-0740           60.0
THU(MAX)   9.5  8.5-0830  7.1-0550  4.5  6.5  6.1-0520  4.5-0040  4.4 45.5 39.0-0810           32.1
   (MIN)   1.0  1.4-0000  3.0-1600  4.5  3.0  3.5-0000  4.4-0000  4.4 15.0 26.2-0910           32.1
FRI(MAX)  10.0  9.7-0700  6.5-0540  4.9                                53.2 33.3-0710           28.8
   (MIN)   2.0  2.3-0330  4.3-0000  4.9                                12.5 21.1-0840           28.8
SAT(MAX)   7.0  6.6-0720  5.5-0320  4.2
   (MIN)   2.5  2.8-1630  3.1-1430  4.2
SUN(MAX)   5.0  4.9-1050  4.5-1030  4.2
   (MIN)   3.0  3.4-0630  3.9-0000  4.2
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SCOTT RESEARCH LABORATORIES                 CPA70-611421113SR049                 RUN DATE 02/10/70-003
SUMMARY GROUND DATA                          09/15/69-09/28/69                              COMMERCE


DAY                        CO                                   HC                                 NOXM
           H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)  10.0  8.0-0540  4.7-0000  2.5  1.0  0.9-1600  0.8-1600  0.7 32.2 23.8-0700            17.6
   (MIN)   0.0  0.0-2030  0.6-1600  2.5  0.4  0.5-1420  0.7-1040  0.7  6.0  8.8-0950            17.6
TUE(MAX)   3.9  3.2-0630  2.3-0610  1.4  4.9  2.3-1120  2.0-0600  1.9 16.7 15.1-0610            11.9
   (MIN)   0.0  0.0-0050  0.8-0000  1.4  1.0  1.4-1530  1.8-0830  1.9  7.9 11.0-1010            11.9
WED(MAX)   4.8  4.3-1040  3.7-0530  2.7  4.2  3.4-1150            3.0 21.2 18.8-0830            15.9
   (MIN)   1.5  1.6-1820  1.9-1600  2.7  2.5  2.6-0630            3.0 11.7 14.2-0640            15.9
THU(MAX)   5.5  4.9-0650  4.3-0520  3.0  4.1  3.3-0940  3.1-0450  2.3 27.2 22.7-0610            19.0
   (MIN)   1.2  1.5-1850  2.2-1600  3.0  1.0  1.3-1850  1.7-1430  2.3  9.9 14.3-0900            19.0
FRI(MAX)   8.3  5.6-0730  4.6-0620  3.1  4.6  3.7-0740  3.2-0630  2.4 29.6 26.4-0620            22.4
   (MIN)   0.3  0.6-2040  1.9-1600  3.1  0.8  1.2-1830  1.5-1600  2.4 17.3 18.9-0840            22.4
SAT(MAX)   4.5  3.4-2100  2.0-1600  1.6  3.3  3.1-0710  1.9-0130  1.7
   (MIN)   0.0  0.5-0430  1.3-0910  1.6  0.5  1.0-0350  1.3-1110  1.7
SUN(MAX)   9.0  8.6-0630  6.2-0120  3.4 10.4 10.2-0610  8.7-0120  4.2
   (MIN)   0.6  1.6-1830  2.0-1130  3.4  0.8  1.1-1550  1.3-1130  4.2


MON(MAX)   5.8  4.6-0040  3.5-0040  2.5  4.6  3.9-0050  2.4-0000  1.5 23.1 19.5-0740            14.8
   (MIN)   0.2  1.0-2010  1.4-1520  2.5  0.2  0.5-1810  0.8-1520  1.5  0.0  8.9-0930            14.8
TUE(MAX)   9.3  8.6-0610  4.5-0350  3.5  4.6  4.0-0610  2.0-0350  1.5 53.5 32.3-0620            18.9
   (MIN)   1.1  1.6-2010  2.8-1450  3.5  0.5  0.9-1950  1.1-1310  1.5  7.0 10.4-0900            18.9
WED(MAX)  11.4  9.4-0640  4.9-0050  4.6  4.3  3.6-0620  2.5-0030  2.4 37.1 31.5-0620            26.9
   (MIN)   2.1  2.7-0120  4.7-0000  4.6  1.3  1.7-0030  2.4-0000  2.4 12.0 23.4-0830            26.9
THU(MAX)   7.9  7.5-0650  3.1-1600  3.9  6.9  5.4-0820  4.4-0230  3.5 29.8 26.6-0800            20.7
   (MIN)   2.0  2.5-1900  2.9-1320  3.9  1.5  1.8-1720  2.4-1340  3.5 10.0 10.9-1100            20.7
FRI(MAX)   9.3  8.5-0720  6.5-0510  4.3  5.0  4.5-1030  4.1-0540  3.0 32.1 28.4-0640            25.6
   (MIN)   1.1  1.4-2110  2.4-1600  4.3  1.6  1.7-2050  2.0-1600  3.0 18.6 24.6-0850            25.6
SAT(MAX)   5.4  4.8-1100  3.8-0420  2.9  4.6  4.0-0930  3.5-0520  2.5 22.2 20.7-0640            18.6
   (MIN)   1.0  1.4-1610  1.9-1440  2.9  1.3  1.4-1810  1.6-1440  2.5 11.0 16.6-0910            18.6
SUN(MAX)   7.7  7.3-0910  6.3-0510  4.7  4.3  4.2-0700  3.6-0440  2.5 29.7 28.1-0720            24.0
   (MIN)   1.9  2.1-0030  3.9-0000  4.7  1.2  1.6-2030  1.9-1420  2.5 17.0 18.4-1030            24.0
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SCOTT RESEARCH LABORATORIES
SUMMARY GROUND DATA                    CPA70-611421113SR049
                                        09/29/69-10/12/69                     RUN DATE 02/10/70-004
                                                                                            COMMERCE
DAY
                        CO                                 HC                                    NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX) 18.4 17.0-0650 11.9-0330  7.1 10.4  9.6-0650  7.2-0330  4.7 70.4 64.1-0650 46.7-0340 41.6
   (MIN)  2.3  2.8-1320  3.4-1200  7.1  2.2  2.3-1700  2.8-1230  4.7 11.2 12.4-1200 39.5-0650 41.6
TUE(MAX) 25.3 22.4-0550 14.1-0120  8.0 13.9 13.1-0620 10.6-0050  6.0 98.7 85.0-0520           59.2
   (MIN)  1.5  1.8-1840  2.9-1230  8.0  1.7  1.9-1710  2.4-1310  6.0 30.1 38.2-0850           59.2
WED(MAX) 19.2 17.9-0640  9.6-0240  4.7 10.9  9.9-0650  6.0-0230  3.2 76.3 70.8-0540           49.5
   (MIN)  0.2  0.4-2240  2.0-1600  4.7  0.8  0.9-2300  1.4-1600  3.2 14.9 19.8-1010           49.5
THU(MAX)  5.6  3.2-0620  2.6-1150  1.9  3.3  2.4-1740  1.8-1400  1.5 23.1 21.3-0540           15.5
   (MIN)  0.1  0.3-0310  1.0-0000  1.9  0.6  0.8-0310  1.1-0000  1.5  9.8 11.9-0810           15.5
FRI(MAX) 13.8  8.9-0550  4.1-0100  2.7  6.1  4.3-0510  2.8-0020  2.3 35.1 30.4-0610           17.3
   (MIN)  0.0  0.5-1210  0.9-0830  2.7  0.6  1.2-0950  1.6-0900  2.3  7.7  8.3-0900           17.3
SAT(MAX) 16.6 15.6-0610  9.0-0010  5.3  8.8  8.5-0610  6.2-0030  3.7
   (MIN)  0.0  0.1-1210  0.6-0950  5.3  0.5  1.0-1300  1.4-1030  3.7
SUN(MAX) 14.0 12.1-2140  6.7-1600  4.9  6.4  5.7-0300  3.8-0040  2.6
   (MIN)  0.0  0.4-1030  1.7-0610  4.9  0.5  0.7-1240  1.3-1020  2.6

MON(MAX) 26.5 24.9-0630 12.1-0030  9.4 10.7  9.4-0620  5.7-0000  4.2122.0111.0-0610           66.6
   (MIN)  1.7  2.6-1150  4.9-0950  9.4  1.2  1.6-1210  2.1-1030  4.2  0.0 37.6-0820           66.6
TUE(MAX) 18.4 16.9-2200 10.9-1600  8.5  8.4  8.1-2200  4.3-1600  3.7 48.9 43.5-0550           28.5
   (MIN)  3.8  4.5-0240  7.0-1150  8.5  1.3  1.6-1610  2.4-1140  3.7  0.0 10.4-0930           28.5
WED(MAX) 24.6 20.7-0620 13.6-0000  9.8 10.1  7.2-0620  6.2-0040  4.1 79.9 43.4-0550           35.9
   (MIN)  3.8  4.4-1910  6.5-1340  9.8  1.0  1.3-1800  2.3-1340  4.1 14.2 36.1-0600           35.9
THU(MAX) 14.7 14.2-0430 10.3-0000  5.0  8.6  7.9-0420  5.9-0000  3.6 70.4 52.3-0520           39.4
   (MIN)  0.8  0.9-2300  2.0-1130  5.0  1.2  1.4-2300  2.0-1600  3.6 28.5 30.6-0810           39.4
FRI(MAX)  9.8  6.8-0530  3.8-0340  2.1  5.6  4.2-0620  3.0-0340  2.1 41.3 33.0-0540           25.0
   (MIN)  0.0  0.3-1300  1.0-1110  2.1  0.4  0.6-1450  1.5-1140  2.1 15.0 19.8-0830           25.0
SAT(MAX) 18.0 12.6-2120  5.9-1600  2.7  8.4  6.7-2130  3.7-1600  2.4
   (MIN)  0.0  0.0-1450  1.1-0350  2.7  1.1  1.2-1010  1.5-0810  2.4
SUN(MAX) 14.6 10.3-0000  4.8-0000  4.5  9.8  7.5-0120  4.4-0000  3.4
   (MIN)  0.1  0.2-0340  1.5-0340  4.5  1.3  1.5-1310  1.8-0820  3.4
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SCOTT RESEARCH LABORATORIES                 CPA70-611421113SR049                    RUN DATE 02/10/70-005
SUMMARY GROUND DATA                           10/13/69-10/26/69                                  COMMERCE

DAY                       CO                                      HC                                        NOXM
           H/L  1HR-TIME   8HR-TIME 24HR   H/L  1HR-TIME   8HR-TIME 24HR   H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX)  13.6 12.6-0000   9.9-0000  7.7   5.6  4.9-0000   3.8-0000  3.0  55.6 47.9-0540             31.2
   (MIN)   3.7  4.2-1630   4.9-1120  7.7   0.4  1.2-1400   1.9-1040  3.0  11.1 23.8-0900             31.2
TUE(MAX)  16.6 15.3-0610  10.9-0030  6.8   6.7  5.9-0600   5.0-0000  3.8
   (MIN)   1.1  1.9-1920   2.3-1540  6.8   1.5  1.5-1140   2.8-0820  3.8
WED(MAX)  10.5  9.2-0540   6.8-0000  3.6   5.9  5.7-0500   5.0-0000  2.8  56.0 29.9-0750             35.4
   (MIN)   0.8  1.1-1940   1.7-1310  3.6   0.5  0.9-1300   1.4-1300  2.8  24.2 27.0-0840             35.4
THU(MAX)   7.9  7.1-0600   5.4-0000  2.9   4.4  4.3-0130   3.7-0000  2.3  44.3 42.2-0610             26.9
   (MIN)   0.0  0.2-2030   0.7-1400  2.9   0.4  0.5-1310   1.1-1230  2.3  11.0 20.5-0720             26.9
FRI(MAX)   4.9  4.1-0640   1.8-0300  1.2   4.1  3.4-0630   2.2-1600  2.0
   (MIN)   0.0  0.2-1720   0.5-1050  1.2   1.0  1.2-1550   1.6-1040  2.0
SAT(MAX)   3.4  1.4-0120             0.9   5.1  3.2-0100   2.0-0030  1.9
   (MIN)   0.0  0.5-0600             0.9   1.0  1.1-0400   1.7-0210  1.9
SUN(MAX)  49.2 17.0-2110   9.0-1600  7.0   5.5  2.3-0330   2.0-0000  2.0
   (MIN)   3.1  4.5-1030   5.3-0940  7.0   1.3  1.5-0830   1.8-0140  2.0

MON(MAX)  24.7 20.4-0700  13.0-0010  9.5  10.7  9.4-2140   5.1-0010  3.6116.5 94.3-0640             59.9
   (MIN)   3.1  3.4-1310   3.9-0840  9.5   0.6  0.7-1140   0.8-0910  3.6   6.6 13.1-0830             59.9
TUE(MAX)  20.5 18.3-0610  11.0-0150  6.7   8.9  7.0-0630   4.8-0000  3.0  79.7 77.0-0620             51.6
   (MIN)   1.3  1.8-2300   3.2-1600  6.7   1.0  1.4-2240   1.9-1600  3.0  25.3 26.5-0900             51.6
WED(MAX)   6.3  5.6-2300   2.3-0140  1.9   5.0  4.0-2300   2.0-0340  1.9  24.1 21.2-0610             17.4
   (MIN)   0.4  0.6-0930   1.5-0840  1.9   0.9  1.2-1830   1.6-1320  1.9   8.4 17.3-0710             17.4
THU(MAX)   6.9  6.0-0920   4.5-0520  3.1   4.5  4.3-0000   3.3-0520  2.6  33.5 31.1-0930             26.5
   (MIN)   0.3  0.9-2300   1.6-1600  3.1   1.1  1.3-1820   1.8-1340  2.6  17.2 23.6-0740             26.5
FRI(MAX)   5.6  4.1-0600   3.1-0450  2.3   3.8  2.9-0740   2.5-0410  2.2  23.1 20.7-0640             18.2
   (MIN)   0.2  0.7-0130   1.9-1220  2.3   1.1  1.3-0120   1.9-1200  2.2  13.0 15.6-0910             18.2
SAT(MAX)  14.3 12.2-0550   9.4-0120  6.9   8.8  7.8-0520   6.7-0020  3.9
   (MIN)   1.2  1.9-1150   3.7-0730  6.9   0.8  1.2-1700   1.7-1200  3.9
SUN(MAX)  17.8 13.7-0020   7.4-0000  4.3  19.5  6.6-0020   5.6-0010  3.9
   (MIN)   0.1  0.5-1710   1.6-1230  4.3   1.2  1.4-1720   2.1-1300  3.9
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SCOTT RESEARCH LABORATORIES                        CPA70-611421113SR049                              RUN DATE 02/10/70-006
SUMMARY GROUND DATA                                 10/27/69-11/09/69                                          COMMERCE

DAY                         CO                                          HC                                         NOXM
          H/L  1HR-TIME   8HR-TIME  24HR   H/L  1HR-TIME   8HR-TIME  24HR  H/L  1HR-TIME   8HR-TIME  24HR

MON(MAX) 11.1 10.1-0020  6.4-0000   5.3  19.6  7.6-0220   5.1-0000   4.2 36.6 35.2-0940 30.0-0450 30.0
   (MIN)  2.0  2.8-2300  4.2-1330   5.3   2.2  2.6-1430   3.2-1300   4.2 19.8 22.1-0620 30.0-0450 30.0
TUE(MAX) 10.5  9.4-1940  6.6-1250   5.2   6.2  5.6-1920   4.5-1250   3.8 56.4 44.2-0900           35.7
   (MIN)  0.7  1.3-0100  3.1-0000   5.2   1.9  2.2-0220   2.9-0000   3.8 19.8 31.0-0720           35.7
WED(MAX) 29.7 24.2-1920 14.3-1600   8.3  13.7 11.9-2020   8.2-1520   5.8 70.9 57.1-0940           40.3
   (MIN)  0.6  1.6-1350  4.9-0000   8.3   2.8  2.9-0220   3.6-0200   5.8 23.7 25.3-1120           40.3
THU(MAX) 26.1 25.2-2050 16.8-1600   8.4  10.2  9.4-1930   6.5-1600   4.1 75.1 60.6-0620           28.9
   (MIN)  0.1  0.5-1010  1.9-0340   8.4   1.5  1.8-1250   2.1-0830   4.1  5.6  8.5-1020           28.9
FRI(MAX) 32.1 29.5-2200 18.3-1600  10.8  11.7 11.0-2030   6.8-1600   3.9 83.2 73.3-0630           36.1
   (MIN)  4.1  4.4-1240  5.9-0840  10.8   0.1  0.2-1240   1.5-0900   3.9 12.6 15.2-1100           36.1
SAT(MAX) 27.1 25.1-2300 12.4-1600   9.3   9.6  9.0-2250   4.8-1600   3.7 60.2 49.0-0640           26.5
   (MIN)  4.0  4.8-1540  5.9-1100   9.3   1.4  1.8-1550   2.5-1220   3.7 10.7 14.8-1020           26.5
SUN(MAX) 30.7 26.3-0150 18.0-0000  12.7  13.9 12.2-0320   8.8-0000   5.5 67.8 46.7-0640           23.7
   (MIN)  4.9  5.3-1130  6.8-0720  12.7   1.4  1.5-1140   2.5-0840   5.5  4.3  9.5-1050           23.7


MON(MAX) 21.9 21.6-0000 14.4-0010  11.8  12.0 10.8-0020   6.5-0010   5.0 45.1 36.3-0910           30.0
   (MIN)  7.0  7.3-1850  8.2-1340  11.8   2.4  2.6-1810   3.3-1240   5.0 18.5 20.0-1110           30.0
TUE(MAX) 25.2 23.8-0650 18.8-0240   9.7  14.0 13.3-0640  10.0-0210   5.6 87.5 85.7-0630           55.9
   (MIN)  1.2  1.8-2030  3.0-1600   9.7   1.7  1.8-1810   2.3-1600   5.6 24.7 29.8-1120           55.9
WED(MAX) 12.0  4.3-0720  2.7-0020   2.2   3.1  2.9-0100   2.3-0000   1.9 19.9 16.6-0800           14.3
   (MIN)  0.5  0.7-2250  2.0-0840   2.2   0.9  1.0-1210   1.4-1140   1.9 10.7 12.3-0900           14.3
THU(MAX)  7.4  6.7-1630  4.3-1220   2.2   3.6  3.0-1550   2.5-1330   1.9 15.6                     10.7
   (MIN)  0.0  0.2-0240  0.7-0000   2.2   0.9  1.0-0350   1.4-0230   1.9  0.0                     10.7
FRI(MAX) 20.0 15.7-2140 12.9-1600   7.6   5.4  5.2-2140   3.6-1600   2.5 32.5 31.0-0630           18.6
   (MIN)  0.3  0.4-0300  2.3-0000   7.6   1.0  1.3-1220   1.6-0830   2.5  7.3 10.9-1010           18.6
SAT(MAX) 18.2 17.4-0030 11.2-0000   9.3   6.8  6.6-0040   4.2-0000   3.0
   (MIN)  3.6  5.1-1440  5.7-0910   9.3   0.8  1.0-1530   1.2-1040   3.0
SUN(MAX) 21.7 19.8-2250 11.9-1600   8.4   4.3  4.0-0030   2.6-0000   2.4
   (MIN)  4.4  5.1-0930  5.8-0520   8.4   1.2  1.7-0750   2.0-0410   2.4
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SCOTT RESEARCH LABORATORIES                CPA70-611421113SR049                RUN DATE 02/10/70-007
SUMMARY GROUND DATA                         11/10/69-11/14/69                              COMMERCE

DAY                     CO                                     HC                                     NOXM
          H/L  1HR-TIME   8HR-TIME 24HR  H/L  1HR-TIME    8HR-TIME 24HR  H/L  1HR-TIME   8HR-TIME 24HR

MON(MAX) 23.4 20.8-2050 12.4-0310 12.5 11.0   9.8-2050   6.6-1520   4.4 74.9 56.5-0700             31.9
   (MIN)  3.5  4.7-1730 11.9-0140 12.5  1.2   1.5-1210   2.3-0910   4.4 10.5 13.8-0950             31.9
TUE(MAX) 13.6 12.8-2300  5.7-1600  3.4  9.8   8.7-2300   4.0-1600   2.9 33.6 28.6-0640             16.5
   (MIN)  0.0  0.2-1120  1.1-0850  3.4  0.8   1.1-1340   1.5-0940   2.9  6.0  9.2-1010             16.5
WED(MAX) 19.8 18.0-2200 10.7-1600  7.6  9.7   8.9-2200   5.6-0000   4.2 56.5 46.1-0640             32.5
   (MIN)  0.6  0.9-1230  1.5-0920  7.6  0.9   1.1-1030   1.4-0910   4.2  9.7 19.4-0910             32.5
THU(MAX) 14.9 13.7-2000  7.8-1600  5.1  7.7   6.6-2000   4.3-1600   3.3 37.1 31.6-0650             24.1
   (MIN)  1.1  1.5-0420  3.3-0840  5.1  1.6   2.0-1210   2.4-1050   3.3 13.6 18.6-0900             24.1
FRI(MAX) 15.4 14.6-0200 10.6-0000 10.1 10.4   9.2-0210   6.7-0000   6.4 62.0 59.8-0630             45.8
   (MIN)  5.7  6.6-0820  8.9-0350 10.1  4.0   4.4-0750   5.7-0350   6.4 32.7 34.4-0810             45.8
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SCOTT RESEARCH LABORATORIES                 CPA70-611421113SR049                RUN DATE 02/10/70-001
SUMMARY GROUND DATA                          08/18/69-08/31/69                             EL MONTE

DAY                      CO                                     HC                                       NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR
MON(MAX)
   (MIN)                                                           22.9 17.4-0800             12.9
TUE(MAX)                                                            8.4  9.4-1200             12.9
   (MIN)
WED(MAX)
   (MIN)
THU(MAX)
   (MIN)
FRI(MAX)
   (MIN)
SAT(MAX)
   (MIN)
SUN(MAX)
   (MIN)

MON(MAX)  1.9                      1.5
   (MIN)  1.0                      1.5                             17.6 15.7-0720             11.0
TUE(MAX)                                                            5.1 15.7-0720             11.0
   (MIN)                                                           21.1 16.4-0910  9.8-0730    9.8
WED(MAX)  2.1                      2.1                              4.3  5.3-1440  9.8-0730    9.8
   (MIN)  2.1                      2.1                             10.9  9.9-0830              8.4
THU(MAX)  2.9                      1.8                              4.7  6.3-0940              8.4
   (MIN)  1.3                      1.8                             21.9 10.9-1000              8.2
FRI(MAX)  7.5                      2.7                              2.8  3.3-1310              8.2
   (MIN)  1.5                      2.7                             11.5  8.2-0700              6.7
SAT(MAX)                                                            3.2  8.0-0750              6.7
   (MIN)
SUN(MAX)
   (MIN)
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SCOTT RESEARCH LABORATORIES              CPA70-611421113SR049                 RUN DATE 02/10/70-002
SUMMARY GROUND DATA                       09/01/69-09/14/69                               EL MONTE

DAY                    CO                              HC                             NOXM
           H/L  1HR-TIME  8HR-TIME  24HR   H/L  1HR-TIME  8HR-TIME  24HR   H/L  1HR-TIME  8HR-TIME  24HR

MON(MAX)
   (MIN)
TUE(MAX)   8.8                       5.5                                  35.7 30.1-0740 19.3-0550  16.5
   (MIN)   3.2                       5.5                                   6.5  7.1-1400 13.4-0940  16.5
WED(MAX)   5.1                       3.9                                  26.3 23.8-0800 16.9-0440  14.1
   (MIN)   2.5                       3.9                                   2.5  5.7-1330 11.6-0910  14.1
THU(MAX)   6.3                       4.2                                  29.8 26.8-0710 16.6-0440  13.8
   (MIN)   2.0                       4.2                                   5.1  5.8-1410 10.9-0930  13.8
FRI(MAX)   4.7                       3.0                                  30.1 28.0-0830 20.0-0440  16.3
   (MIN)   1.2                       3.0                                   0.9  6.2-1410 13.1-0940  16.3
SAT(MAX)
   (MIN)
SUN(MAX)
   (MIN)


MON(MAX)                                                                  47.4 38.3-0940 24.8-0520  20.0
   (MIN)                                                                   6.9  7.5-1450 14.2-0950  20.0
TUE(MAX)                                                                  47.8 42.0-0730 29.7-0510  26.8
   (MIN)                                                                   7.8 12.4-1250 24.1-0810  26.8
WED(MAX)  10.3  9.1-0840             7.1                                  57.4 48.8-0810 33.5-0540  31.0
   (MIN)   2.3  4.5-1240             7.1                                   8.1 10.3-1150 30.0-0800  31.0
THU(MAX)   8.3                       5.2                                  36.6 31.4-0840            24.5
   (MIN)   4.0                       5.2                                  10.2 24.1-1010            24.5
FRI(MAX)   6.0                       3.6                                  31.7 21.9-0830 16.0-0700  15.4
   (MIN)   1.6                       3.6                                   6.1  6.9-1430 14.5-0740  15.4
SAT(MAX)
   (MIN)
SUN(MAX)
   (MIN)
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SCOTT RESEARCH LABORATORIES          CPA70-611421113SR049          RUN DATE 02/10/70-003
SUMMARY GROUND DATA                   09/15/69-09/28/69                     EL MONTE

DAY                     CO                        HC                              NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)  4.7  2.0-1350            1.8                               76.5 24.7-1220           11.4
   (MIN)  0.5  1.9-1410            1.8                                6.1  7.1-1320           11.4
TUE(MAX)  3.1                      2.3                               13.2 12.5-1110           10.3
   (MIN)  1.5                      2.3                                5.6  6.5-1410           10.3
WED(MAX)  3.7                      2.2                               15.1 12.6-0940           11.4
   (MIN)  0.6                      2.2                                8.8 10.4-1410           11.4
THU(MAX)                                                             20.7 19.4-1010           16.4
   (MIN)                                                              9.9 11.7-1150           16.4
FRI(MAX)                                                             16.4 14.4-0940           12.4
   (MIN)                                                              7.8  9.0-1320           12.4
SAT(MAX)
   (MIN)
SUN(MAX)
   (MIN)

MON(MAX)  2.5                      1.8                               17.2 11.8-0730            8.3
   (MIN)  1.2                      1.8                                4.3  5.1-0940            8.3
TUE(MAX)  7.2                      3.6                               36.7 33.9-0810           15.7
   (MIN)  2.1                      3.6                                4.7  7.2-1220           15.7
WED(MAX)  5.5  5.3-1010            4.1                               23.7 23.1-0950           15.6
   (MIN)  2.7  4.9-0940            4.1                                8.8  9.1-1620           15.6
THU(MAX)  5.3                      4.2                               21.3 19.7-0910           16.5
   (MIN)  3.1                      4.2                                6.4 12.0-1440           16.5
FRI(MAX)  5.4  3.9-1430            4.3                               27.2 25.7-0850           21.0
   (MIN)  3.3  3.9-1430            4.3                                5.8 16.8-1310           21.0
SAT(MAX)  6.9                      4.5  5.4  5.4-1240  3.9-1040  4.0 22.8 20.1-0740           15.2
   (MIN)  2.6                      4.5  2.9  3.0-1750  3.6-1430  4.0  7.6  8.6-1350           15.2
SUN(MAX)  6.4  4.4-1010            4.2  5.6  5.4-0640  4.9-0320  4.2 25.6 23.5-0850           14.5
   (MIN)  2.4  4.4-1010            4.2  2.7  3.1-1530  3.7-1430  4.2  7.0  7.9-1140           14.5
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SCOTT RESEARCH LABORATORIES            CPA70-611421113SR049             RUN DATE 02/10/70-004
SUMMARY GROUND DATA                    09/29/69-10/12/69                             EL MONTE

DAY                    CO                                  HC                                    NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR
MON(MAX)   9.9  8.2-1110            5.1   7.5  6.6-1110  5.0-0550  4.1  36.4 31.9-0740           18.8
   (MIN)   1.7  4.7-1200            5.1   2.3  2.6-1600  3.1-1310  4.1   8.5  9.8-1250           18.8
TUE(MAX)  18.4 13.5-0740            5.0   7.9  6.9-2300  4.8-0550  4.1  72.5 60.7-0750           24.8
   (MIN)   1.5  5.9-0850            5.0   1.7  1.9-1500  2.9-1320  4.1   6.9 19.2-1010           24.8
WED(MAX)  10.1                      4.2  10.3  9.8-0620  7.7-0000  4.5  50.3                     20.8
   (MIN)   0.7                      4.2   1.5  1.7-1920  2.0-1330  4.5   4.4                     20.8
THU(MAX)   1.5                      1.2   2.3  2.3-2240  1.8-1600  1.8   9.0                      7.7
   (MIN)   0.7                      1.2   0.8  1.4-1920  1.7-1250  1.8   6.8                      7.7
FRI(MAX)   2.7                      1.4   8.1  6.5-2210  4.3-1600  3.2  16.5                      8.0
   (MIN)   0.8                      1.4   1.1  1.3-0900  1.9-0740  3.2   4.4                      8.0
SAT(MAX)                                 12.0 10.6-2300  6.9-1600  4.8
   (MIN)                                  1.4  1.5-1010  1.8-0930  4.8
SUN(MAX)                                 11.2  9.5-2230  7.5-0000  5.2
   (MIN)                                  1.9  2.2-1120  2.3-0940  5.2

MON(MAX)   7.9  1.4-1410            2.9  12.8 10.4-2110  7.6-1600  6.0  38.7 33.7-0750           15.9
   (MIN)   0.7  1.2-1350            2.9   1.9  2.0-1250  2.7-0900  6.0   3.4 30.6-0800           15.9
TUE(MAX)  13.2 11.7-0730            4.2  10.2  9.6-2140  7.6-0000  5.3  52.9 47.8-0730           21.0
   (MIN)   0.3 11.7-0730            4.2   1.4  1.7-1300  1.9-0930  5.3   3.0 13.6-0920           21.0
WED(MAX)  10.8  8.0-0720            4.4  10.4  9.2-0240  7.8-0000  5.9  35.7 30.7-0740           20.0
   (MIN)   2.1  3.2-1340            4.4   3.3  3.5-1220  4.0-0850  5.9   9.7 25.8-0830           20.0
THU(MAX)   9.4  3.0-0930            3.3  12.8 12.3-0600  9.4-0010  5.3  44.0 35.2-0740           18.4
   (MIN)   1.6  2.4-1120            3.3   2.0  2.2-1600  2.7-1320  5.3   7.2 13.7-0940           18.4
FRI(MAX)   4.1  0.9-1330            1.8   7.4  6.4-0620  4.0-0310  3.2  20.6 18.8-0750           12.9
   (MIN)   0.6  0.9-1330            1.8   1.5  1.6-0040  2.4-0850  3.2   6.0 16.3-0820           12.9
SAT(MAX)                                 12.9  9.4-2210  6.1-0000  4.5
   (MIN)                                  1.2  1.7-1030  2.2-0850  4.5
SUN(MAX)                                 10.5  9.7-0030  7.2-0000  4.4
   (MIN)                                  1.0  1.6-1610  1.9-0910  4.4
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SCOTT RESEARCH LABORATORIES                 CPA70-611421113SR049                  RUN DATE 02/10/70-005
SUMMARY GROUND DATA                          10/13/69-10/26/69                                 EL MONTE


DAY                         CO                                  HC                                  NOXM
          H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)  6.3  3.0-1010            2.3 18.9  9.3-0620  7.0-0000  4.8 36.0 30.0-0800            15.8
   (MIN)  0.7  1.1-1330            2.3  0.6  1.8-1230  2.4-0920  4.8  5.3 15.4-1020            15.8
TUE(MAX) 12.8                      3.0  9.6  8.7-0600  7.1-0000  4.2 43.1 37.9-0730            18.8
   (MIN)  0.5                      3.0  1.4  1.5-1630  1.8-1220  4.2  4.2 21.9-0850            18.8
WED(MAX)  6.9  3.0-0750            2.1  7.9  7.2-0630  5.9-0000  3.9 21.6                      11.3
   (MIN)  1.1  1.5-1350            2.1  1.9  2.1-1010  2.4-0850  3.9  7.2                      11.3
THU(MAX)  6.4  1.4-1400            2.2  7.9  7.2-0110  3.2-0440  3.4 20.8 17.1-0740            11.6
   (MIN)  0.9  1.4-1400            2.2  1.4  1.7-1830  1.9-1340  3.4  5.8 11.4-0910            11.6
FRI(MAX)  2.6  1.4-0850            1.3  5.2  5.0-2300  3.6-1600  2.6 17.9 15.8-0740            10.9
   (MIN)  0.7  1.4-0850            1.3  0.9  1.2-1410  1.8-0910  2.6  5.0 15.1-0750            10.9
SAT(MAX)                                7.5  5.5-0550  4.7-0000  3.0
   (MIN)                                0.5  1.3-1240  1.7-1010  3.0
SUN(MAX)                                8.7  8.6-2210  5.4-1600  3.8
   (MIN)                                1.4  1.7-1010  2.0-0830  3.8


MON(MAX)  0.8                      0.3 10.4  9.2-0610  7.4-0000  4.8 31.3 21.8-0720             8.2
   (MIN)  0.1                      0.3  0.9  1.3-0950  1.6-0900  4.8  1.7  5.8-0810             8.2
TUE(MAX) 20.9 18.2-0740            7.9  8.1  7.7-0640  6.5-0040  4.4 66.5 56.3-0720            24.6
   (MIN)  1.4  2.1-1410            7.9  1.7  2.2-1140  2.5-0910  4.4  6.9  8.2-0940            24.6
WED(MAX)  3.8                      1.6  6.9  6.0-2300  4.1-0000  3.4 19.8 17.9-0810            11.2
   (MIN)  0.5                      1.6  1.2  1.5-1050  2.1-0910  3.4  4.5  7.8-0900            11.2
THU(MAX)  3.5                      2.6  6.2  5.8-0000  4.4-0000  3.8 21.2 18.5-0740            12.4
   (MIN)  1.8                      2.6  2.3  2.8-1020  3.2-0840  3.8  8.7  9.6-0940            12.4
FRI(MAX)  4.2                      2.7  6.4  6.1-2300  4.1-1600  3.6 12.2 10.5-0750             8.0
   (MIN)  1.9                      2.7  2.2  2.5-0230  3.2-0100  3.6  0.3  8.7-0840             8.0
SAT(MAX)                               11.3 10.1-0310  7.9-0020  5.5
   (MIN)                                2.4  2.5-1700  3.0-1130  5.5
SUN(MAX)                                8.9  8.4-2300  7.6-0000  5.5
   (MIN)                                1.8  2.7-1050  3.1-0920  5.5
```

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SCOTT RESEARCH LABORATORIES              CPA70-611421113SR049              RUN DATE 02/10/70-006
SUMMARY GROUND DATA                       10/27/69-11/07/69                               EL MONTE

DAY                    CO                                      HC                                  NOXM
           H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR  H/L  1HR-TIME  8HR-TIME 24HR

MON(MAX)   5.6                        4.5 10.0  9.6-0220  8.0-0000  6.4 23.8 22.9-1010             18.2
   (MIN)   2.7                        4.5  3.2  3.7-1600  5.0-1310  6.4 13.9 18.8-0850             18.2
TUE(MAX)   8.9                        5.3  9.6  9.0-2300  6.4-1600  5.5 27.4 24.1-0830             18.3
   (MIN)   3.5                        5.3  4.0  4.4-0050  4.8-0030  5.5  9.7 10.9-1400             18.3
WED(MAX)   8.4                        4.3 16.1 15.2-2120 11.4-1600  7.2 25.5 22.5-0840             12.8
   (MIN)   2.2                        4.3  2.4  2.6-1500  4.0-0900  7.2  4.0  9.3-1030             12.8
THU(MAX)  19.2                        6.4 13.7 12.4-0640  9.3-1600  7.2 64.8 61.4-1820             19.9
   (MIN)   0.3                        6.4  2.0  2.1-1050  2.7-0850  7.2  2.3  3.8-1200             19.9
FRI(MAX)  30.4 25.8-1900             10.3 18.0 16.8-2150 11.7-1600  7.5 83.0 70.8-1920             25.3
   (MIN)   1.4 23.8-1850             10.3  2.3  2.5-1150  3.0-0900  7.5  5.0 11.1-0930             25.3
SAT(MAX)   4.7  4.2-0850              2.9 15.8 14.8-2030  9.6-1600  7.6 19.5 17.0-0850             10.5
   (MIN)   1.3  2.7-1320              2.9  2.6  2.8-1420  3.5-0910  7.6  7.0 15.5-0910             10.5
SUN(MAX)   2.7                        1.5 15.2 14.7-0210 11.8-0000  7.9 11.3 10.0-0850              6.2
   (MIN)   0.1                        1.5  2.4  2.5-1250  3.5-0940  7.9  3.1 10.0-0850              6.2

MON(MAX)   9.4                        6.6 13.2 12.7-0600 10.4-0000  7.1 37.1 21.0-0930             14.8
   (MIN)   4.2                        6.6  3.0  3.2-1100  4.6-1010  7.1  7.7 12.5-1010             14.8
TUE(MAX)  15.9                        6.8 14.6 12.5-0700 10.1-0020  6.7 44.6 37.7-1100 23.6-0740 23.2
   (MIN)   2.6                        6.8  3.2  3.6-1400  4.3-1330  6.7  8.1  9.2-1350 22.8-0900 23.2
WED(MAX)   2.1                        1.1  4.6  4.2-0000  3.4-0000  2.5 10.9  9.9-0850              7.4
   (MIN)   0.5                        1.1  1.5  1.6-2110  1.8-1510  2.5  5.4  8.7-0940              7.4
THU(MAX)   2.8                        1.7  4.2  3.1-0030  2.6-1400  2.2  9.7                        6.6
   (MIN)   1.2                        1.7  0.9  1.0-0420  1.6-0330  2.2  5.2                        6.6
FRI(MAX)   2.0                        1.5  4.4  4.0-0640  2.8-0050  2.6  6.6                        5.8
   (MIN)   1.1                        1.5  1.5  1.6-1010  2.7-0510  2.6  4.9                        5.8
```

7. DISCUSSION OF DATA FOR SEPTEMBER 29, 1969

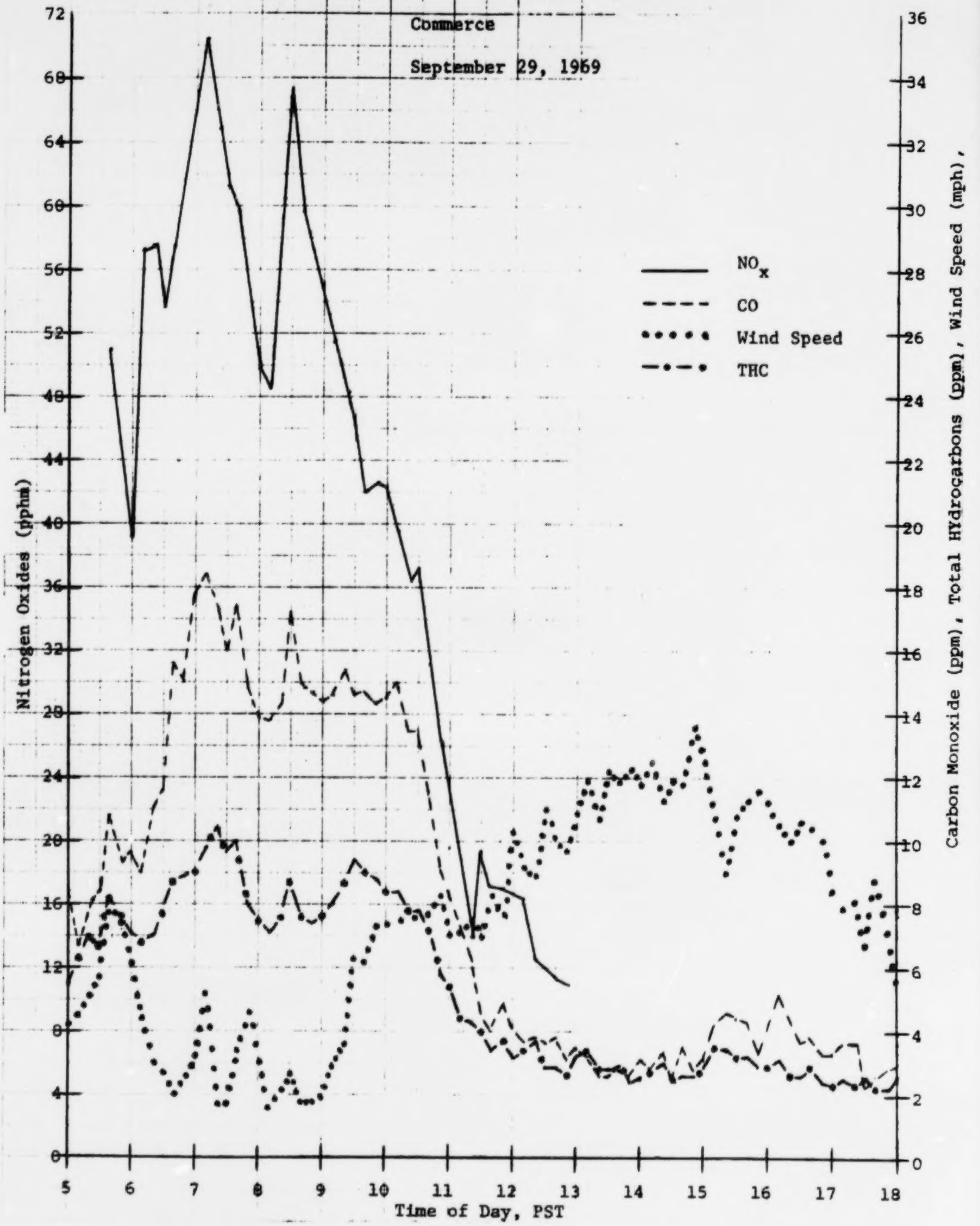
September 29 was one of the highest oxidant days during the program period and a day on which all phases of the test program were active. There are ground data for Commerce and El Monte and vertical profile data for the two ground sites plus Hawthorne airport. Thus, we have data for three points approximately ten miles apart and nearly falling on a straight line in the southwest to northeast direction common to that of the sea breeze at the ground sites. In addition, ESSA launched a tetroon in a field adjacent to the Commerce site in mid-morning, tracked its course and collected samples in the vicinity of the tetroon by use of a helicopter. The data from these various phases are discussed in the following paragraphs to show their interrelationship and to demonstrate how they can be utilized in defining the aerometric history of a typical smoggy day in the Los Angeles Basin.

7.1 COMMERCE GROUND DATA

The pattern of contaminant concentrations and wind speed for the Commerce site is shown in Figure 7-1. The pattern of individual nitrogen oxides and photochemical products is shown in Figure 7-2. Information missing from the data print out has been supplied from the appropriate strip charts.

A moderate contaminant buildup had occurred prior to 0600 despite the 4 to 6 mph wind which had persisted over the several hours previous. The apparent very low inversion and the wind shift to the west at 0500, which transported air from the downtown area to Commerce, probably accounted for the buildup. At 0600 the concentrations of carbon monoxide (CO) and

Figure 7-1 DIURNAL PATTERN OF POLLUTANTS AND WIND SPEED



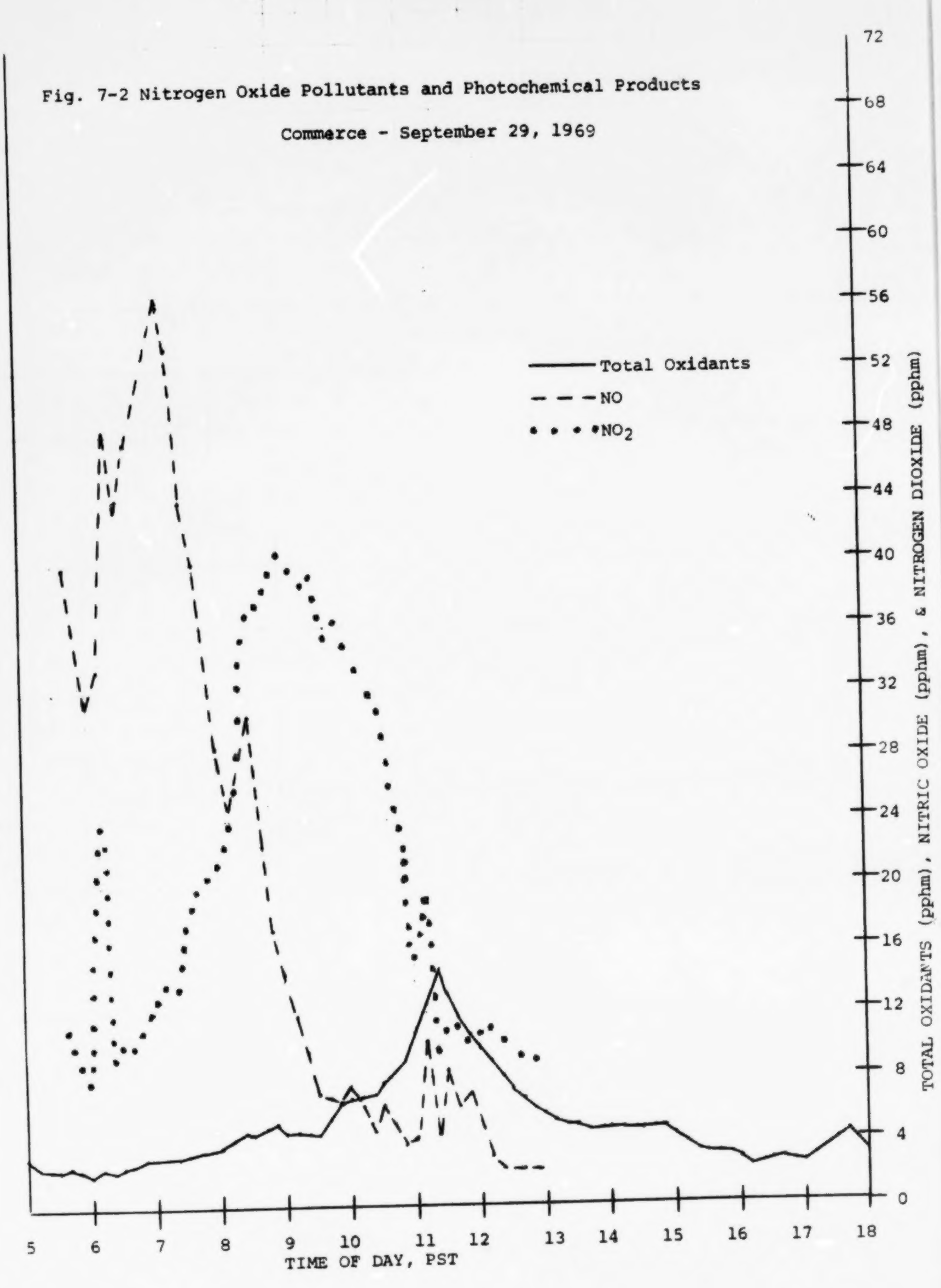


Fig. 7-2 Nitrogen Oxide Pollutants and Photochemical Products

Commerce - September 29, 1969

nitrogen oxides (NO_x) were 10 ppm and 50 pphm respectively. Approximately 80% of the NO_x was present as nitric oxide (NO) and only 20% as nitrogen dioxide (NO_2). The hydrocarbon composition showed a normal distribution of the cracked combustion products: acetylene, ethylene and propylene and of gasoline range hydrocarbons, but the C_1 to C_3 paraffins were unusually high.

Shortly after sunrise the wind diminished and shifted to the northeast quadrant. Contaminant concentrations increased during the morning traffic peak and reached a maximum concentration of 18 ppm CO, 70 pphm NO_x and 10 ppm hydrocarbons at 0710. They then began to decrease slowly. The photochemical conversion of NO to NO_2 proceeded at an apparent rate of 2.5 ppb per minute, and the 50% of conversion point was reached at 0810. At 0820 a temporary wind shift to the west resulted in a small increase in all contaminants, and a leveling off of the UV intensity was noted. At 0910 the wind speed began to increase and its direction stabilized in the southwest quadrant, the usual sea breeze direction.

Ozone was first observed at 0940 when the NO_x composition was 15% NO and 85% NO_2 for a NO_2 to NO ratio of 5.7. Ozone increased at a slow rate (0.6 ppb per minute) for the next hour. The Mast Recorder strip chart shows severe downspikes during this period indicating that fresh emissions were reacting with ozone. This means that the ozone concentrations measured at the sampling point 25 feet above ground were probably lower than in the remainder of the air parcel between that point and the inversion base. The oxidant trace eventually stabilized and increased rapidly reaching a maximum of 14 pphm (11 pphm ozone) at 1120. A trace of PAN ($\sim$1 ppb) was detected at this time.

The photochemical activity that occurred during this period was reflected by the changes in hydrocarbon composition between 0515 and 1015. The ethylene to acetylene ratio decreased from 0.99 to 0.80 and the propylene to acetylene ratio from 0.27 to 0.18. The concentrations of most less reactive hydrocarbons increased by approximately 50% but those of the C_1 to C_3 paraffins remained the same. Contaminant concentrations began to decrease rapidly at 1030 indicating that the air mass which had received the major portion of early morning emissions had passed to the northeast. The CO decreased by 2/3 from 1030 to 1130, and at the same time the air became drier (lower dew point) and the UV increased to normal clear sky levels.

Ozone decreased in half during each of the two hours following the 1120 maximum and remained at low levels for the balance of the day. Other contaminants likewise remained at low concentrations as the wind persisted at 10 to 12 mph from the west until sunset.

7.2 EL MONTE GROUND DATA

The patterns of contaminant and photochemical product concentrations for El Monte are shown in Figures 7-3 and 7-4. The contaminant data begins at 0740. Concentrations were 60% of those at Commerce but the conversion of NO to NO_2 was already well past the 50% point. The only possible explanation for this is that the proportion of NO_2 present at sunrise was considerably larger than the 20% found at Commerce. The excess of ethane and propane found at Commerce was not present at El Monte, and the aromatics were 50% higher in relation to the gasoline range paraffins. Higher aromatic levels were a common occurrence at El Monte.

Ozone first appeared at 0840 when the NO_x composition was 17% NO and 83% NO_2. Ozone increased at a steady rate of 1.2 ppb per minute over

Figure 7-3 DIURNAL PATTERN OF POLLUTANTS AND WIND SPEED

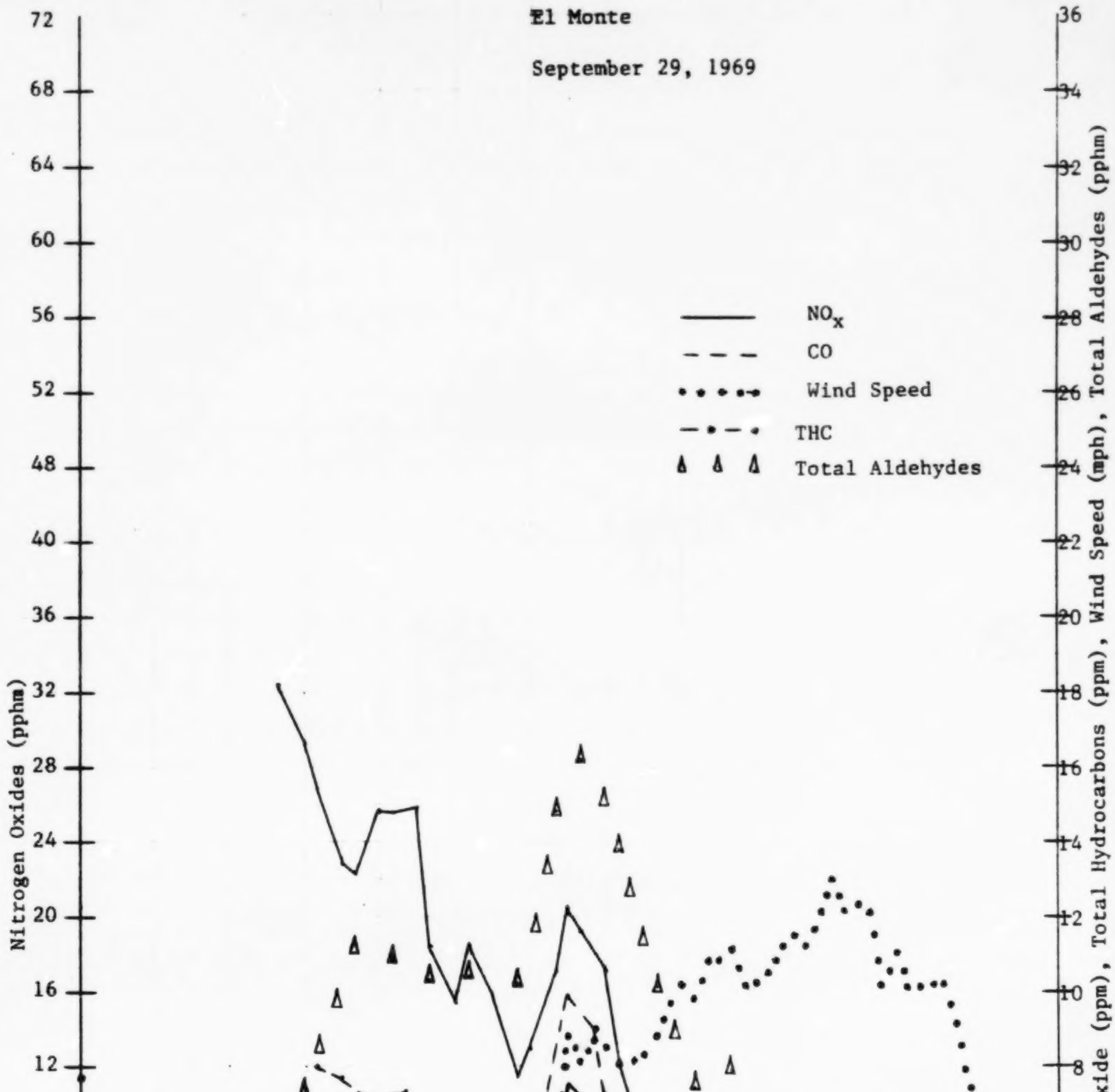
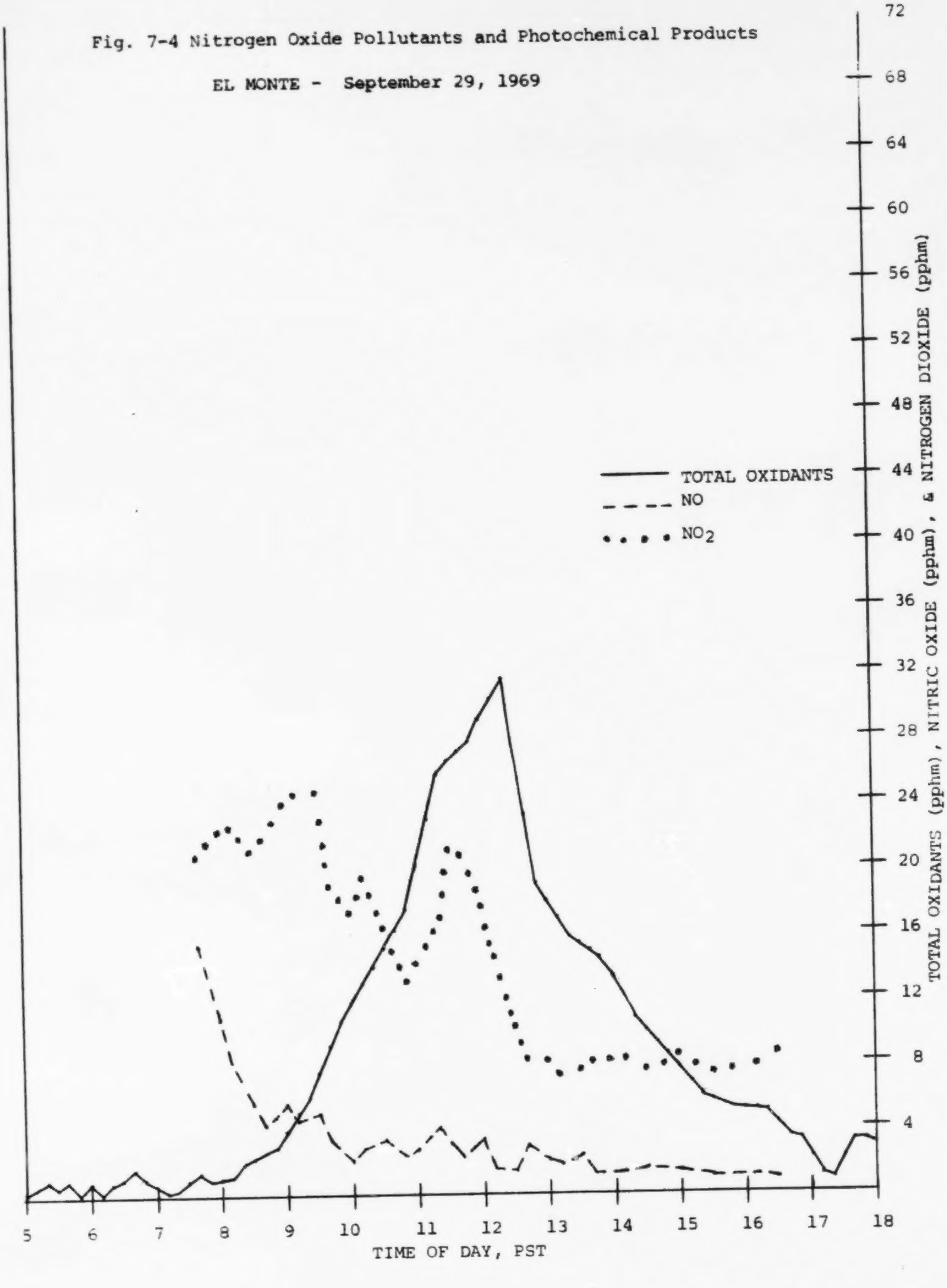


Fig. 7-4 Nitrogen Oxide Pollutants and Photochemical Products

EL MONTE - September 29, 1969



the next two hours as the wind remained light and variable, and contaminant concentrations decreased slowly. The wind shifted from east to southwest at 1000 and its speed increased slowly. The arrival of a more highly polluted air mass was noted at 1100 when CO, NO_x, hydrocarbons and ozone all increased sharply. All contaminants reached their maxima at 1130. The CO decreased by a factor of 3 from 1130 to 1230 and other contaminants followed suit as the wind continued from the southwest at 10 to 12 mph. On the other hand, oxidant and ozone continued to increase to a maximum of 32 pphm oxidant and 28 pphm ozone at 1220. Ozone decreased by less than half during each of the several hours following its maximum. PAN was first detected at 0916. Its concentration increased from 1 to 6 ppb at the oxidant maximum and was barely detectable one hour after the maximum. Aldehydes reached a maximum of 16 pphm at 1140 and then decreased to 8 pphm over the next two hours.

The chromatographic data for 1100, 1155 and 1245 portray the changes in hydrocarbon composition and concentration which took place as the new air mass passed through. The ESSA tetroon data to be discussed later suggest that the polluted air transported to El Monte from 1100 to 1200 came from an area well to the south of Commerce. Except for methane, the concentrations of most hydrocarbons doubled from 1100 to 1155, but the composition showed no significant changes. By 1245 hydrocarbon concentrations had decreased to just below the level at 1100 and source differences were evident. The C_1 to C_3 paraffins decreased slightly. Acetylene decreased by 50% as did CO. In addition, C_4 to C_6 paraffins remained the same but aromatics and higher paraffins decreased by as much as 50%. This suggests that at 1245 there was much less contribution from exhaust and more from evaporative processes.

7.3 AIRBORNE DATA

Two flights were made, the first from 0750 to 0930 and the second from 1150 to 1320. The four temperature and dew point profiles for El Monte are shown in Figure 7-5, the eight profiles for Commerce in Figures 7-6 and 7-7, and the four for Hawthorne in Figure 7-8. Oxidant profiles are shown in Figures 7-9 and 7-10.

A strong inversion base near 700 feet MSL is indicated at Commerce by the temperature profiles and CO concentrations at 0810. At 700 feet the CO is half the ground level as are the concentrations of individual hydrocarbons. At 1000 and 1500 feet the CO is one tenth of the ground level. Despite the low concentrations of contaminants, the oxidant above the inversion base exceeds 10 pphm which is substantially higher than below the inversion.

The profiles at Hawthorne show that the inversion is at approximately the same altitude as at Commerce. The layer of moist air normally present at low altitudes near the coast is illustrated by the dramatic decrease in dew point between 700 and 800 feet. A mass of dry air centered at 2000 feet can be seen here as well as at the other sites.

The 0900 profile at Commerce shows that the CO at 700 feet had increased to 80% of ground level. The inversion had lifted slightly but otherwise the profile was similar to that at 0810. The 0920 El Monte profile shows a sharp break in temperature and dew point at 900 feet. The CO at 700 feet is approaching the ground concentration while that at 1100 and 1500 feet is ten times lower. The oxidant exceeded 10 pphm at most points under the inversion except at ground level. The hydrocarbon

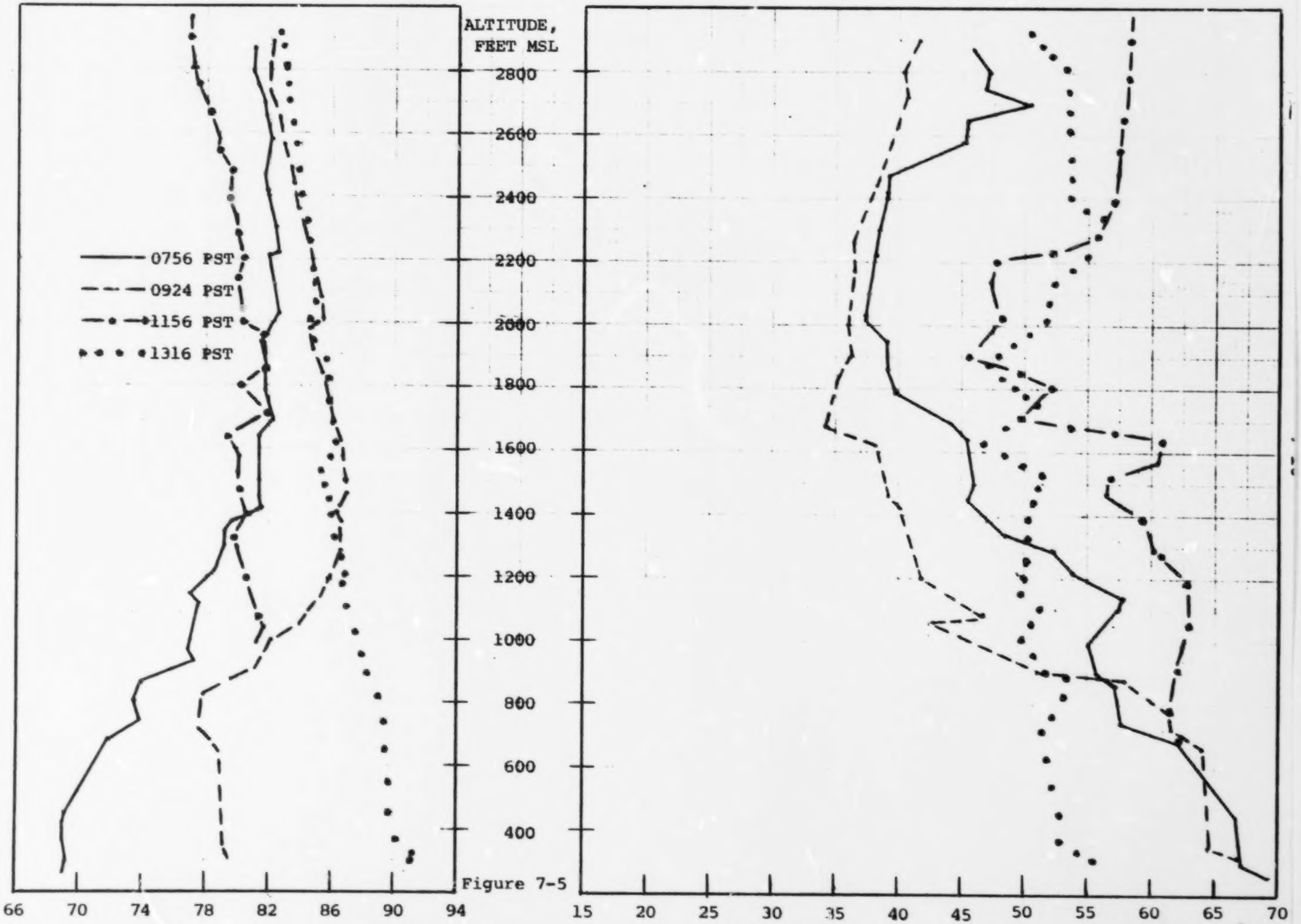


Figure 7-5

VERTICAL PROFILE OVER EL MONTE, SEPTEMBER 29, 1969

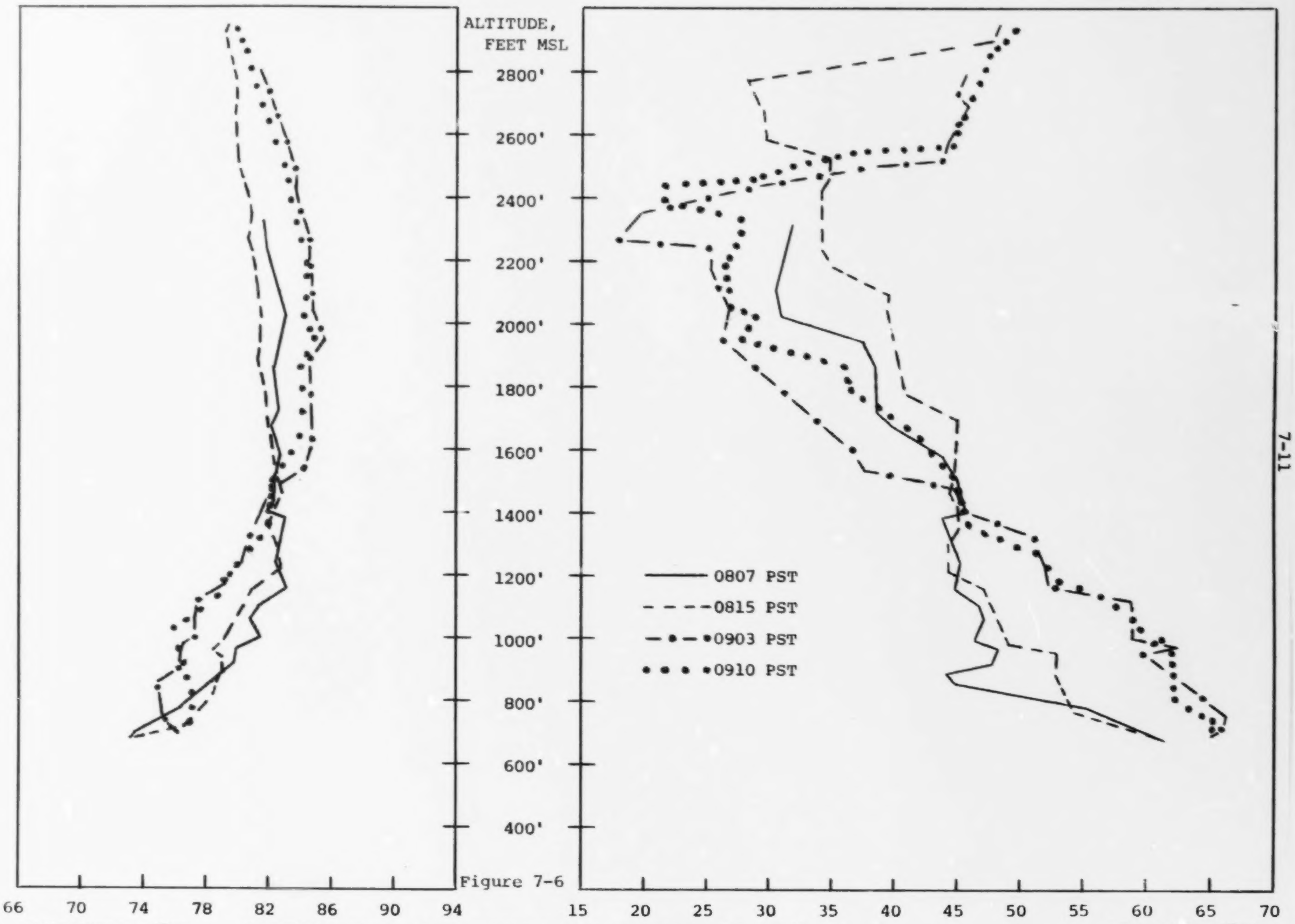


Figure 7-6

VERTICAL PROFILE OVER COMMERCE, AM, SEPTEMBER 29, 1969

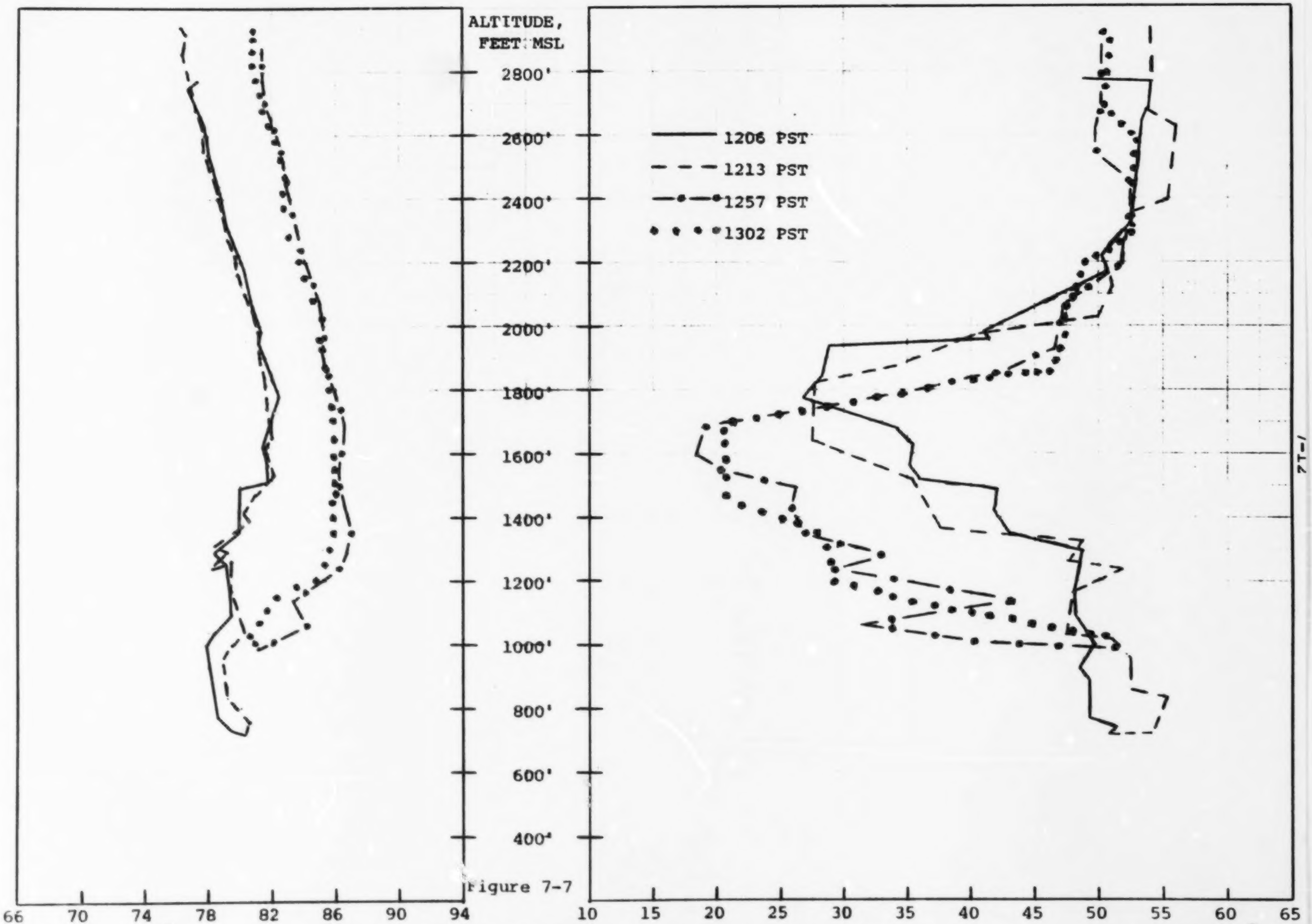


Figure 7-7

VERTICAL PROFILE OVER COMMERCE, PM, SEPTEMBER 29, 1969

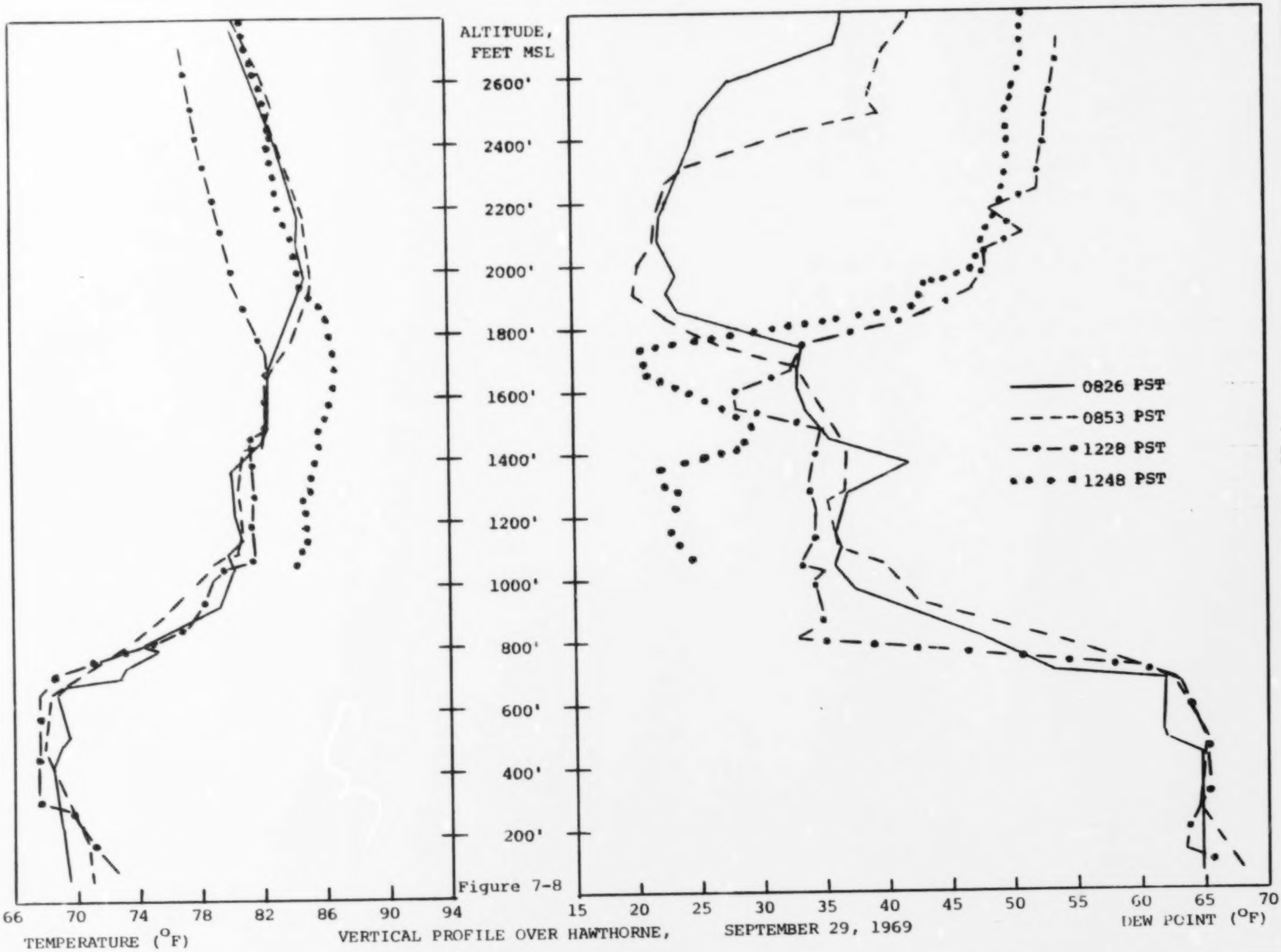


Figure 7-8 VERTICAL PROFILE OVER HAWTHORNE, SEPTEMBER 29, 1969

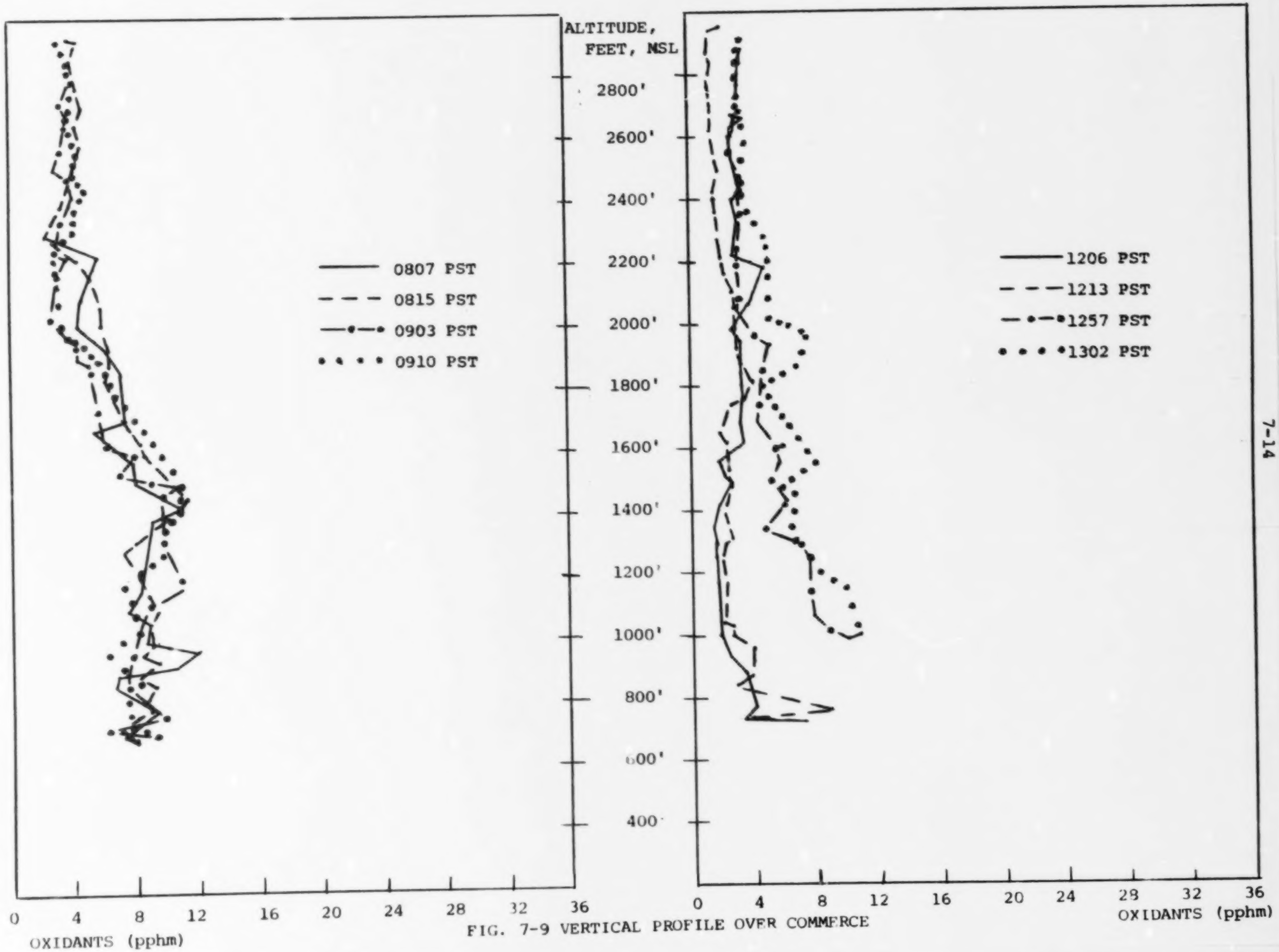


FIG. 7-9 VERTICAL PROFILE OVER COMMERCE

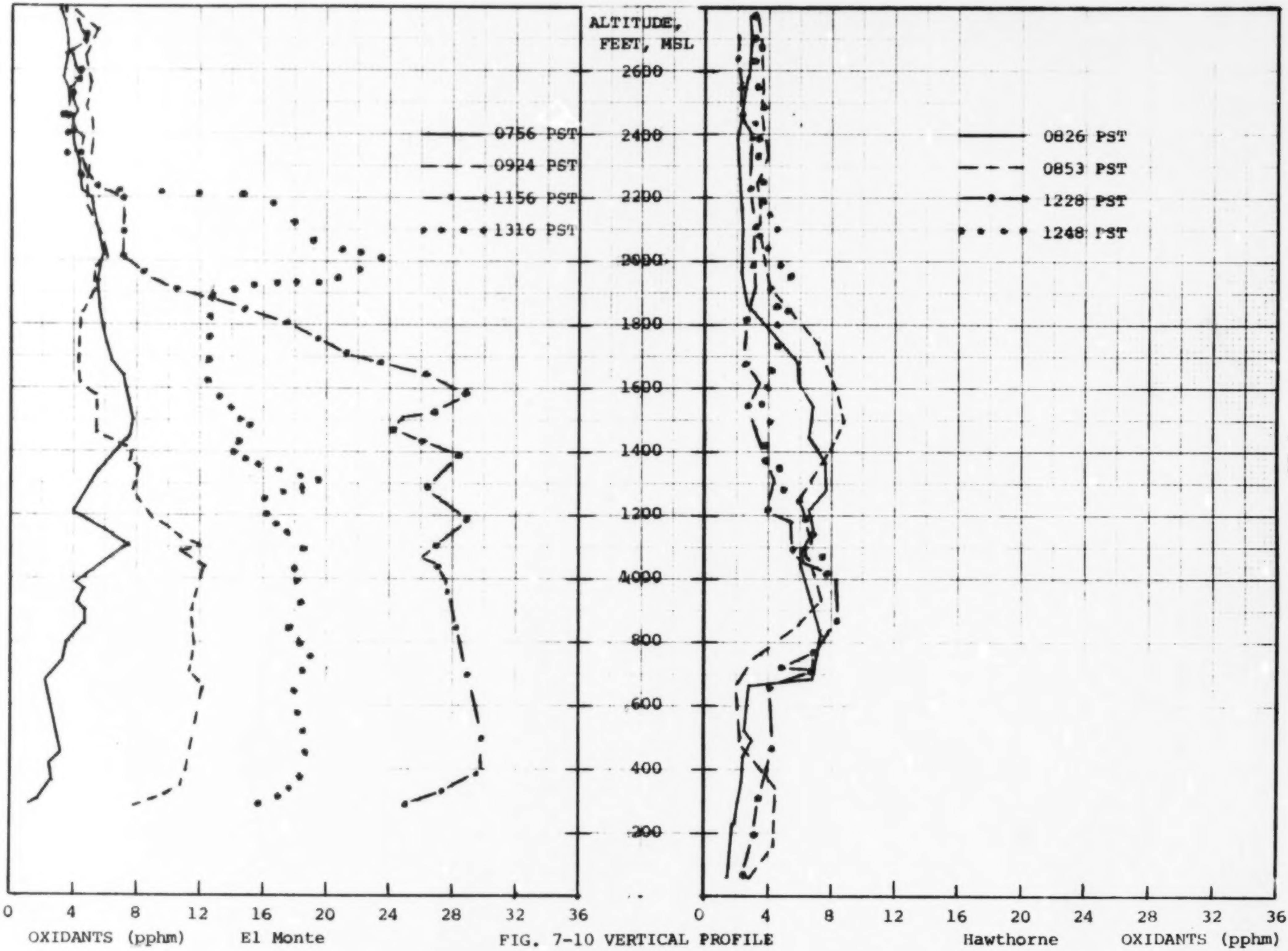


FIG. 7-10 VERTICAL PROFILE

concentrations at 700 feet were at least as high as at ground level except for the aromatics which were lower. Most hydrocarbons were 5 times lower at 1100 and 1500 feet than at 700 feet.

The first set of profiles on the 1150 flight show that the inversion was beginning to break up at El Monte and Commerce but was unchanged at Hawthorne. The high altitude dry air mass had been compressed and dropped to the 1800 foot level at Commerce and Hawthorne. The oxidant exceeded 20 pphm from ground level to 1700 feet at El Monte but at Commerce it was 4 pphm or less at all points above 800 feet with an indication of a low layer with concentrations of 8 pphm from the ground to 750 feet. The Commerce CO and hydrocarbon concentrations at 700 and 1000 feet were similar, with the 1000 foot sample having higher hydrocarbons than the 700 foot sample, but CO was little more than half the ground concentration. Concentrations at 1500 feet were substantially lower. Hawthorne's oxidant changed little since the earlier flight with the highest concentrations around 1000 feet and very low concentrations below the inversion.

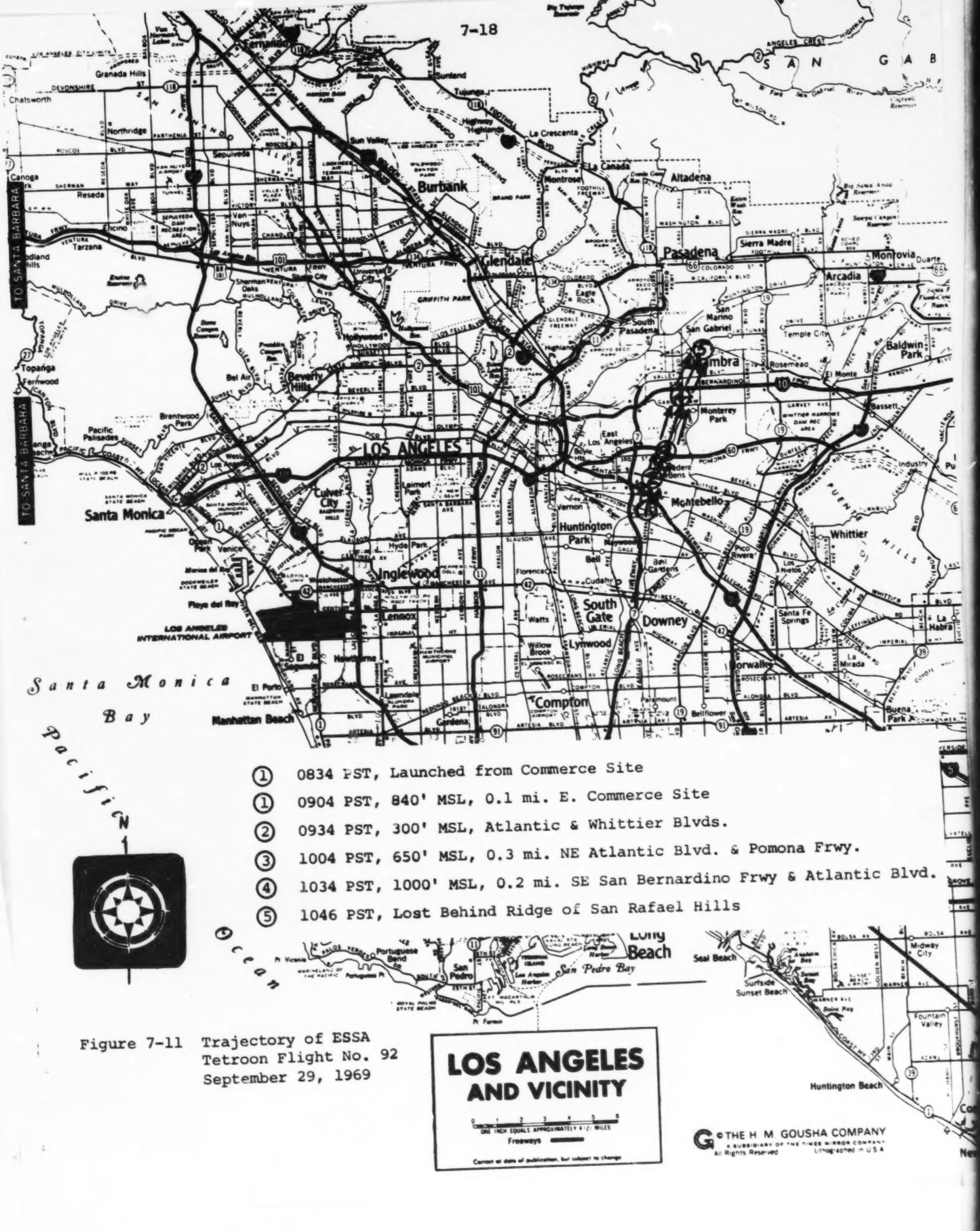
The profiles at 1300 still show vast differences between Commerce and El Monte. The inversion was still present at Commerce and the oxidant increased during the descent to 10 pphm at 1000 feet. The CO at 1000 feet was similar to that in the profile an hour earlier. At El Monte the inversion was gone and the temperature profile was close to the adiabatic lapse rate while the dew point was nearly the same from ground level to 3000 feet. The oxidant likewise was nearly uniform from the ground to 2200 feet. The CO was approximately the same at ground level, 700 feet, 1100 feet and 1500 feet. The hydrocarbon at ground level, 1100 and 1500 feet were similar in concentration and composition except for the much lower ethylene to acetylene and propylene to acetylene ratios aloft which demonstrate the greater extent to which photochemical reactions had proceeded.

7.4 ESSA DATA

ESSA launched a tetroon from a field adjacent to the Commerce site at 0834. The trajectory followed by the tetroon is illustrated in Figure 7-11. During the first half hour the wind was light and variable, and the tetroon remained in the immediate vicinity of the launch site. A sample collected at 650 feet MSL at 0857 showed CO and NO_x concentrations about 80% of those at the ground. The wind direction stabilized in the southwest quadrant at 0910, and the tetroon began to follow a northeasterly course. A sample collected at 1300 feet at 0924 contained much lower concentrations of contaminants but higher oxidant, the same as was found in aircraft samples collected above the inversion base.

By 0936 the tetroon had travelled 1 1/2 miles to the northeast and by 1001 an additional mile in the same direction. Samples collected at these points at 620 and 750 feet respectively had much the same concentrations as the earlier sample at 650 feet except that the oxidant had doubled from 0857 to 1001. At the same time the NO_2 to NO ratio increased and the ethylene to acetylene and propylene to acetylene ratio both decreased, all indicating photochemical reactions were proceeding within the air parcel.

The next ESSA sample was collected at 1024 PST four miles to the northwest of the 1001 sample. The composition of this sample, which was not collected in the vicinity of the tetroon, was substantially different from the 1001 sample in that the CO and hydrocarbons were only slightly



① 0834 PST, Launched from Commerce Site

① 0904 PST, 840' MSL, 0.1 mi. E. Commerce Site

② 0934 PST, 300' MSL, Atlantic & Whittier Blvds.

③ 1004 PST, 650' MSL, 0.3 mi. NE Atlantic Blvd. & Pomona Frwy.

④ 1034 PST, 1000' MSL, 0.2 mi. SE San Bernardino Frwy & Atlantic Blvd.

⑤ 1046 PST, Lost Behind Ridge of San Rafael Hills

Figure 7-11 Trajectory of ESSA
Tetroon Flight No. 92
September 29, 1969

lower but the NO_2 was lower by a factor of six. The air probably originated in the downtown Los Angeles area. The large difference in CO/NO_x and HC/NO_x ratios between the 1001 and 1024 samples may have been due to a difference in the original composition of the two air parcels or reactions which removed NO_2 from the downtown air parcel.

The tetroon was travelling in a northeasterly direction at four to five miles per hour when it passed a point five miles due west of the El Monte ground site at 1040. The tetroon was lost by the radar as it passed behind a ridge of the San Rafael Hills at 1046. At this time the helicopter had landed at El Monte to transfer bag samples. Upon returning to the sampling area, the helicopter observers were unable to locate the tetroon, so subsequent samples were collected along the route where the downtown air mass appeared to have been transported. Samples collected between 1131 to 1318 showed a continuing increase in oxidant and decrease in contaminants. The complete file of ESSA data will provide a valuable input to explaining the happenings of September 29.

7.5 SUMMARY

The aerometric events of the day at the three points covering a 20 mile cross-section of the Los Angeles Basin were substantially different. In early morning the vertical profiles were similar. As the day progressed little change occurred at the point nearest the coast (Hawthorne), oxidant formation at the mid-point (Commerce) was interrupted by the passage of a fresh air mass, and high oxidant levels were reached at the inland point (El Monte). By early afternoon the highest oxidant at Hawthorne was still above the inversion base ($\sim$1000 feet). At Commerce the highest oxidant was from ground level to the inversion base while at El Monte the inversion had disappeared and the oxidant was uniformly high from ground level to 2200 feet. The higher oxidant at El Monte appeared to be due solely to the longer irradiation time which its air parcel had undergone.

This section has been aimed at demonstrating how information from the various data files can be combined to depict the events in a wide area of the Los Angeles Basin on a single high oxidant day. An expanded study of data for this day and others in the period can provide a basis for generating a three-dimensional model of the Basin.

8. MISCELLANEOUS OBSERVATIONS ON INTERESTING PHENOMENA

A number of interesting phenomena occurred for which data were recorded during the field program. We will point out some of these and provide background information to assist in interpreting the data.

Periodic data were collected at the ground sites on two weekends: September 27-28 and November 1-2. Airborne data were also collected on September 27 and November 1. The data summary shows that the pollutant concentrations on weekends were similar to those on weekdays, but the daily patterns may be different.

On September 11 a solar eclipse occurred from mid-morning to early afternoon with 70% coverage at its maximum point. The ground data show that photochemical reactions were slowed down and the start of the strong sea breeze was delayed. The ozone maximum at El Monte occurred at 1410 which was up to two hours later than for other days in the same period. Two flights were made, one during the eclipse and one shortly after its conclusion.

Smog fronts were traversed in flights on September 30, October 29 and November 1. The relatively large compositional differences from one side to the other are illustrated in the airborne data file. Horizontal profiles of the Basin were explored where the location column in the data file is marked "Special".

High overnight contaminant concentrations occurred toward the end of the test period as the inversion base dropped to low altitudes. The composition of this stagnant air which had not been exposed to radiation can be compared to that of the irradiated stagnant air found during the morning on high oxidant days. Samples were analyzed for hydrocarbons from sunset to nearly midnight at each site on several different days in late October and early November.

The source of the excess propane which was found in the 1968 and 1969 programs as well as in previous investigations of the Los Angeles atmosphere has been a mystery. The excess cannot be accounted for by exhaust emissions or natural gas leaks. The propane was unusually low at Commerce on October 30 and 31 and also at El Monte on the morning of the 31st. At the same time a strong odor of natural gas was noted at Commerce but the methane concentration was normal. This suggests that it was the odorant and not the gas which was leaking. It is speculated that a shutdown of some portion of a natural gas odorizing facility may have led to the reduced propane levels. An investigation into the circumstances surrounding the natural gas odor could shed light on the source of excess propane.

The differences in hydrocarbon composition noted from day to day and within days at each site and also between sites merit further study. Significant contributions from sources other than vehicular exhaust are strongly suggested by the substantial variations in hydrocarbons which are relatively non-reactive photochemically which occurred. The hydrocarbon composition of integrated exhaust samples from many vehicles should remain nearly constant.

The ESSA program produced a number of interesting samples. A sample in a power plant plume, where a strong odor of sulfur dioxide was noted, showed no CO or hydrocarbon differences from the nearby marine air but nitrogen oxides were somewhat higher. Samples collected over Torrance contained very low acetylene concentrations as compared to other hydrocarbons including ethylene and propylene. This suggests a source of light olefins other than combustion. Similar trends were found in other samples collected in the southern part of the Los Angeles Basin. Local sources appeared to exert a strong influence on samples collected at low altitudes in many parts of the Basin. Clean marine air samples with minute traces of contaminants were also collected. The ESSA program certainly demonstrated the non-homogenuity of the Basin atmosphere.

9. ACKNOWLEDGEMENTS

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Our special thanks are extended to Mr. Wallace Linville, chief of the USPHS Vehicle Compliance Field Laboratory, for being most cooperative toward our use of the facilities of the laboratory in which the Commerce trailer was located.

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